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Weapon Training
1942

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CHAPTER I

PRINCIPLES AND SYSTEM OF TRAINING

1. General

1. Skill in the use of weapons, individually by the soldier and in combination by leaders, is one of the first essentials for victory in battle. Small Arms Training shows a system of teaching which, if followed, not slavishly in the letter but in principle, with common sense, will produce this skill. It consists of two volumes.

Volume I deals with all small arms weapons; particulars concerning training in them; the application of their fire against the enemy on the ground and in the air. It consists of a series of pamphlets numbered and titled as follows:—

- No. 1. Weapon Training.
- No. 2. Application of Fire.
- No. 3. Rifle.
- No. 4. Light Machine Gun.
- No. 5. Anti-Tank Rifle.
- No. 6. Anti-Aircraft.
- No. 7. .303-inch Machine Gun (in three parts).
- No. 8. Mortar (2-inch).
- No. 9. Mortar (3-inch).
- No. 10. Range-finder No. 12.
- No. 11. Pistol (.38-inch).
- No. 12. Bayonet.
- No. 13. Grenade.
- No. 14. }
- No. 15. } Range Courses—All Arms (not applicable during
- No. 16. } the war).
- No. 17. }
- No. 18. Range Courses (War).
- No. 19. Anti-Tank Gun.
- No. 20. .303-inch Lewis Machine Gun.
- No. 21. Thompson Machine Carbine.
- No. 22. Sten Machine Carbine.
- No. 23. 29mm. Spigot Mortar.

Volume V contains details regarding the construction and maintenance of ranges and apparatus for weapon training.

2. Four conditions are essential to the production of effective fire from small arms in battle :—

- i. A high standard of individual skill in the use of weapons and in judging distance, or range-taking.
- ii. The co-operation of skilled individuals to form an effective fire unit under a leader.
- iii. Ability on the part of platoon and higher commanders to direct fire to the best advantage.
- iv. Ability on the part of fire unit commanders to control the fire of their units and on the part of the men to recognize the target.

3. The object of weapon training, therefore, is :—

- i. To make the man proficient in handling and firing his weapons in such a way as to give him confidence in them, and in his own ability to kill enemy with them.
- ii. To train men to work together in a fire unit under a commander.
- iii. To ensure that commanders are competent to train their men, and are themselves proficient in fire control.
- iv. To provide instructors who are capable of producing the above results.

Note.—Where necessary, "regiment", "squadron", "battery" or "troop", etc., should be read for "battalion," "company" and "platoon". Where applicable, the term "machine gun" includes the light and Vickers machine guns.

4. A fully qualified instructor should be able :—

- i. To train recruits or men who possess little or no knowledge of a particular weapon.
- ii. To exercise trained men.
- iii. To train junior commanders in fire direction and control.
- iv. To train officers, warrant officers, and N.C.Os. to be instructors.

5. No individual can be considered fully trained unless he is able to use efficiently any of the weapons with which he may be armed, and particularly when wearing a respirator. To ensure maintenance of this standard, frequent practice is necessary, and weapon training of the leader and soldier should take place throughout the year.

6. Sufficient mechanism required for the care and maintenance of weapons is included in this book. Further knowledge if required may be obtained from the Text Book of Small Arms and from instructions in the possession of unit armourers.

2. Safety precautions during training

1. The detailed safety precautions necessary during training, especially when ammunition is used, are laid down in this pamphlet. Any building that contains explosives should be considered as an explosive store, and should be dealt with, as far as possible, in accordance with Magazine Regulations.

2. Drill rounds are employed in training and are essential for efficiency. There is, however, a risk of accidents through their becoming mixed with live ammunition. To prevent accidents, inspections will be carried out at the beginning of each lesson. Instructors will :—

- i. Inspect all weapons.
- ii. Inspect all ammunition pouches, M.G. belts and boxes, magazines, and carriers, to ensure that no live ammunition is present.
- iii. Inspect all drill rounds.
- iv. Show their own weapons and drill rounds to the squad under their instruction.
- v. Inspect grenades and grenade stores, and order the first safety precaution to be carried out in grenade training.

Drill rounds will never be used in aiming at an aiming disc held to the eye.

When drill rounds are used for setting up stoppages with automatic weapons on the range, officers conducting the practice will supervise their issue and subsequent collection.

3. Storage of ammunition.—Ammunition should be kept perfectly dry and clean, and should not be exposed to extremes of temperature. In no circumstances will drill rounds be kept in, or issued from, the same store as that used for ball or blank ammunition.

4. No cartridges, other than those supplied by the R.A.O.C., will be used in service weapons.

3. Principles of instruction

1. Instruction will be given, when practicable, in the following sequence :—

Explanation ...	...	Instruction by the ear.
Demonstration ...	...	Instruction by the eye
Execution ...	...	Imitation of the demonstration and correcting mistakes.
Repetition ...	...	Practice to improve.

Execution should follow demonstration as soon as possible, in order that the lesson is more readily impressed on the mind of the soldier.

Accuracy and speed in execution should be obtained gradually by repetition, until men are able to handle their weapons by sense of touch alone.

2. A good instructor requires the following :—

- i. Common sense and enthusiasm.
- ii. Sympathy with, and interest in, those under instruction, and an understanding of their outlook.
- iii. Knowledge of his subject.
- iv. A clear idea beforehand of the lessons to be taught and the method of teaching them.
- v. The ability to encourage by praise where praise is due, and sufficient self-restraint to avoid sarcasm.
- vi. The ability to use his own words rather than a repetition of the words in the book.

4. Hints to instructors

1. No method of instructing will be effective unless it possesses simplicity and interest. The following are a few general hints to the instructor :—

- i. However experienced he may be, preparation of the next day's work is essential, and the necessary stores must be placed ready for use before the beginning of each lesson.
- ii. The interest of the men must be roused and maintained. Instructors will be encouraged (especially when they are exercising trained soldiers) to present the subject matter of the lessons in the most ingenious way they can devise. Variety of subjects assists, but apart from this much depends on an instructor's manner. He should be brief and keep to the point, avoiding non-essentials. Competition stimulates keenness and team spirit, but the tendency to sacrifice accuracy for speed must be guarded against.
- iii. He will be careful to avoid personal mannerisms which distract the attention of a squad. He must learn to speak quietly, slowly, and distinctly, and to avoid either a monotonous tone of voice or shouting.
- iv. In giving demonstrations, he must be accurate in his movements.
- v. Questions and answers develop quickness of thought and ease of expression. This fact applies particularly to subjects where only one weapon is available for

the whole squad. Questions should be addressed to the whole squad and not to one particular individual; then, after a sufficient pause, one man should be asked for the answer. A regular sequence of questioning should be avoided. Thus the whole squad will have to consider the answer and will be kept on the alert.

- vi. He must expect and look for mistakes. Encouragement should follow correction. In correcting faults, he should make a man correct himself. A brief demonstration of the fault, and interrogation afterwards, are valuable means of bringing it home to the man. Faults due to slackness or neglect should be dealt with firmly, but criticism after an honest effort must be such as will produce a further and better effort. Good work should always be acknowledged.
- vii. He will give a brief explanation of what he is about to teach at the beginning of each lesson, and when a new subject is introduced.
- viii. Where a single weapon (i.e. L.M.G. and A.Tk. rifle) is used, the instructor must so position his squad that they can see easily the action of the weapon in which instruction is being given.
- ix. One of his most important duties is to be able to coach a firer on the range. For this work patience and practical experience are necessary, combined with a sympathetic study of each individual's abilities. Details of the method of coaching will be found in Appendix II.

2. Every N.C.O. and man will be in possession of a record book (A.B. 142) suitable to his weapon training category. These books will be issued to recruits as soon as their weapon training begins (Pamphlet No. 3, Lesson 1). They must be carefully preserved and kept up, and will be brought on all weapon training parades, or when firing on the range takes place.

5. Tests of elementary training

1. Advanced weapon training and range practices are a waste of time and ammunition unless those taking part have reached a certain standard of efficiency.

The tests of elementary training give the required standard. They are designed to :—

- i. Ensure that recruits have reached an efficient standard before they begin range practices.
- ii. Ensure that trained soldiers are efficient.

iii. Prevent any detail of elementary training being overlooked.

iv. Enable officers charged with the preparation of individual training programmes to determine what proportion of the time available should be allotted to the various subjects.

2. A record of the results of individual tests will be kept by company commanders and inspected periodically by unit commanders.

3. Extracts from the record of tests will always be furnished by the company commanders concerned when a soldier is transferred from one company to another. In addition, all soldiers will have a record of their performances kept for them in their record books.

4. At the beginning of individual training, records will be examined to see which subjects require most practice. Where no records exist, men should be tested and the programme made out on the results of the tests. Towards the end of the training, tests should again be carried out to ascertain the progress made.

5. It is important that teaching should not be confused with testing. In the former, men are instructed by explanation and demonstration, followed by execution; in the latter, men are questioned or ordered to carry out a certain test, after due warning, without assistance, and they either pass or are put back for further instruction. The conditions of each test will be explained to individuals or sections before it is carried out.

6. The conditions of the various tests of elementary training are given in the pamphlets for each weapon, and in the record book (A.B. 142). The person conducting the test will at its conclusion enter the result in the presence of the individual tested.

6. Preparation of programmes

1. Progressive instruction is ensured only by means of programmes, which require careful consideration in their preparation.

2. Programmes may be required with one of the following objects in view :—

- i. Recruit training at the training centre.
- ii. Post training centre weapon training.

iii. To exercise the trained soldier.

iv. To train instructors.

v. To refresh instructors.

vi. To prepare officers and N.C.Os. for a course at a Small Arms School.

3. When preparing a programme, the officer concerned should consider the following :—

- i. The commanding officer's policy.
- ii. The number of working days available, and whether the instruction will be continuous or interrupted; the hours of work each day, and the time of year.
- iii. The number of periods required to carry out the syllabus, and the daily allocation of periods.
- iv. The number of instructors available, and the number of men under instruction. The strength of squads should not exceed eight.
- v. The standard of knowledge of the men to be instructed.
- vi. The places of work and type of ground available. These must be considered from the points of view both of fine and wet weather.
- vii. The equipment and stores available and required for instruction.

4. The officer, having decided on the object of the course and considered the above points, should :—

- i. Make a list of subjects to be taught, i.e. a syllabus.
- ii. Arrange subjects and lessons in logical sequence.
- iii. Group subjects together in the syllabus and allot periods.
- iv. Allot time for practice and mutual instruction, in such subjects as require it.
- v. Allot time for tests and examinations (if necessary).

5. Lessons should be taught in the sequence shown in the syllabus and should be clearly numbered in the programme, to ensure that it is obvious to both instructor and student which lessons are to be taught.

6. It is advisable to prepare a complete programme for the whole course of instruction, which should then be subdivided into weekly and daily programmes. The weekly programme should be issued during the previous week to enable instructors to prepare the work. The daily programme should be suitably arranged for both dry and wet weather; it will often be advisable to have alternative programmes.

7. The following are a few general hints to be considered in preparing programmes :—

- i. Variation of the subject maintains interest and dispels monotony.
- ii. So arrange subjects that those under instruction have alternately a difficult and easy period.
- iii. Start the day with a vigorous subject, such as bayonet training.
- iv. Allow time for movement from places of work.
- v. Arrange for a " break " during the morning's work.
- vi. If possible, lectures should take place in the evening, particularly in winter.

A N.C.O. should be made responsible for the preparation and arrangement of the equipment and apparatus required for the day's instruction (*see* para. 3, vii, above). He should be provided with copies of all programmes and informed of any alterations.

8. A period of instruction should not exceed 45 minutes. All lessons have been so designed that they can be completed in this time, but many will require repetition.

7. Sequence of training

1. The recruit is taught weapon training at the training centre. The weapons, and allotment of hours to the various subjects, are given below. The first lesson on any weapon should be a demonstration of its capabilities and limitations, both from the point of view of firing and from that of the enemy. Once the elementary instruction in the principles of aiming, trigger pressing, holding, and positions has been shown and learnt, which can be done indoors, the recruit must learn to apply these conditions to battle conditions. It is unsound to repeat lessons under easy conditions. There must be progression. The lessons should be carried out under more difficult conditions and be made as practical as possible. Once the recruit has left his training centre particular attention must be paid to the more advanced lessons of weapon training. Lessons such as advanced and section handling with the L.M.G., handling with the mortar and anti-tank rifle, the assault practice with the bayonet, are examples of these advanced lessons. They require constant repetition, and repetition on different types of ground. When carrying out these lessons instructors must be particularly alert that small points of elementary training, learnt in the earlier basic lessons, are scrupulously observed. The culmination of weapon training is field firing.

THE RECRUIT'S WEAPON TRAINING SYLLABUS*

*To be issued shortly.

8. Exercising the trained soldier

1. In exercising the trained soldier, the method adopted for recruit instruction will be modified, and the system employed will be that of practising the soldier in the use of his weapons, rather than teaching him.

2. The squadron or company commander should endeavour to ensure that the programmes are so arranged that all the men are being practised in subjects in which they require to maintain their standard of efficiency. N.C.Os. and men who have proved themselves efficient will not carry out unnecessary repetitions, but will be instructed in more advanced subjects. The instructor carrying out the programme must avoid detail, except with backward men whom it may be necessary to "teach" in those subjects in which they are below standard.

3. The following special points should be considered in preparing programmes for trained soldiers:—

i. The object may be:—

(a) Preparation for the passing of tests of elementary training.

(b) Improving any weakness shown in tests of elementary training.

(c) Preparation for the war course or for field firing.

ii. The individuals who are to be exercised are trained soldiers and, therefore, do not require detailed instruction; they need only to be practised and refreshed in those subjects which have a direct bearing on the object for which the programme is designed.

iii. Maintain interest and avoid monotony by variation of the subjects, and by conducting each period in as ingenious and novel way as possible. Nothing leads to boredom more quickly and more surely than too rigid an adherence to set sequences and actions. Boredom is the worst enemy of Weapon Training, and instructors must exercise their ingenuity to defeat it.

iv. So frame the programme that exercises which require physical exertion alternate with those of a less strenuous nature.

CHAPTER II

THE THEORY OF SMALL ARMS FIRE

9. General

1. In order to obtain the full fire effect from the weapons with which they are armed, it is necessary for all ranks to have a working knowledge of the theory of small arms fire. Those wishing to study the subject in further detail should consult the Text Book of Small Arms.

2. This chapter deals with the elementary theory of the fire of a single rifle and with the theory of the fire of an automatic weapon.

3. The following demonstrations, using tracer, should be given to the soldier in explanation of Sec. 10 below.

i. Trajectory of the bullet at various ranges.

ii. Necessity for sight adjustment.

iii. Effect of wind.

The contents of Sec. 11 should be studied by all officers and fire unit leaders.

10. Elementary theory (rifle)

1. Description of Mark VII ammunition, cartridge, and bullet.—The cartridge case is of solid drawn brass, and has a rim at the base by which the cartridge is positioned in the chamber and extracted.

i. It contains the propellant charge.

ii. Sealing of the chamber is effected by the expansion of the walls of the case on firing.

iii. It carries the means of ignition.

The bullet is pointed and has a lead core enclosed in a cupro-nickel envelope. The advantage of the elongated bullet is that it has greater weight in proportion to the surface directly opposed to the air and is, therefore, better able to overcome the resistance of the air; thus its velocity is assisted, and greater range and striking power are obtained.

2. Rifling.—A barrel is said to be rifled when it has spiral grooves cut down the bore (see Fig. 1).

3. When a weapon is fired, certain factors, which are explained below, at once begin to act on the bullet.

i. Before the bullet leaves the barrel

(a) *Force of explosion.*—When a round of ammunition is fired, the gases formed by the burning of the charge push the bullet forward through the bore

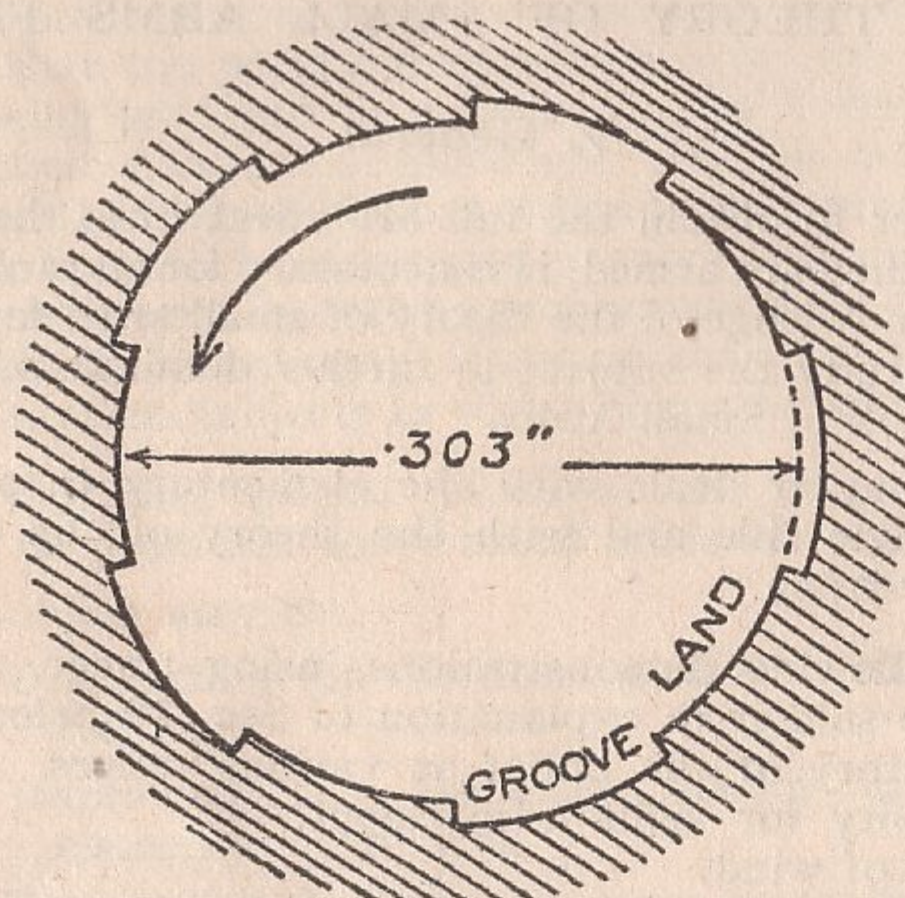


FIG. 1.

to the muzzle, and out into the air. With Mark VII ammunition the velocity with which the bullet leaves the muzzle is 2,440 feet a second. With A.Tk. rifle ammunition it is about 2,600 feet a second.

(b) *Rifling.*—When the charge is fired, the bullet is forced against the grooves along the barrel and, consequently, when it leaves the muzzle it has acquired a spinning motion. This tends to keep the nose foremost and to ensure steadiness in flight, with resultant accuracy. This spinning also enables an elongated bullet to be used.

(c) *Movement due to recoil.*—When the weapon is fired, the explosion, together with the bullet forcing its way through the barrel, sets up a vibratory movement which may result in a difference between the prolongation of the axis of the bore before firing and the line of departure to the bullet. This difference, expressed as an

angle, is known as "jump", and compensation is made by adjustment of the foresight before the rifle leaves the factory.

(d) *Oily barrel.*—If shots are fired with an oily barrel, abnormal vibration and, consequently, erratic shooting will occur until the oil is burnt up.

(e) *Oily cartridge.*—Should the chamber or cartridge be oily or wet, extra back-pressure will be developed on the bolt head, breech block, or lock, because of lack of friction between the case and the chamber. This back-pressure will affect vibration, and erratic shooting will result.

(f) *Stocking up of the rifle,* i.e. the fitting of the fore-end to the barrel and body.—This is most carefully done at the factory. Any warping of the fore-end or loosening of screws, or the presence of any foreign body between the fore-end and the barrel, may affect the jump and thereby affect the shooting of the rifle.

(g) *Effect of firing with the bayonet fixed.*—The weight of the bayonet may affect the jump and the shooting of the rifle.

Normally with Mark VII ammunition the jump is upwards, and allowance has to be made, but no two rifles shoot exactly alike. As a rough guide, a bullet fired from the average rifle with a bayonet fixed at 300 yards range strikes the target about 1 foot above the point which it would have struck had the bayonet not been fixed.

Every man must ascertain the shooting of his own rifle.

(h) *Resting the rifle.*—This may affect the jump. The effect will be reduced to a minimum when the rifle is rested at the point of balance.

ii. After the bullet leaves the barrel.

(a) *Resistance of the air.*—This causes the velocity of the bullet to decrease rapidly, and allows it to travel only about 600 yards in the first second, about 400 yards in the second second, and about 300 yards in the third second.

(b) *Gravity.*—This acts on the bullet immediately it leaves the muzzle, drawing it downwards with increasing speed.

These two factors cause the bullet to travel in a curved path; the fall of the bullet becoming steeper as the range increases.

Definitions

4. *The axis of the barrel* is an imaginary line following the centre of the bore from breech to muzzle.

The line of departure is the direction which the bullet takes on leaving the muzzle. Theoretically this line is in prolongation of the axis of the barrel, but generally it differs from the latter by an amount depending on the jump.

The line of fire is the direction of the target from the muzzle of a weapon.

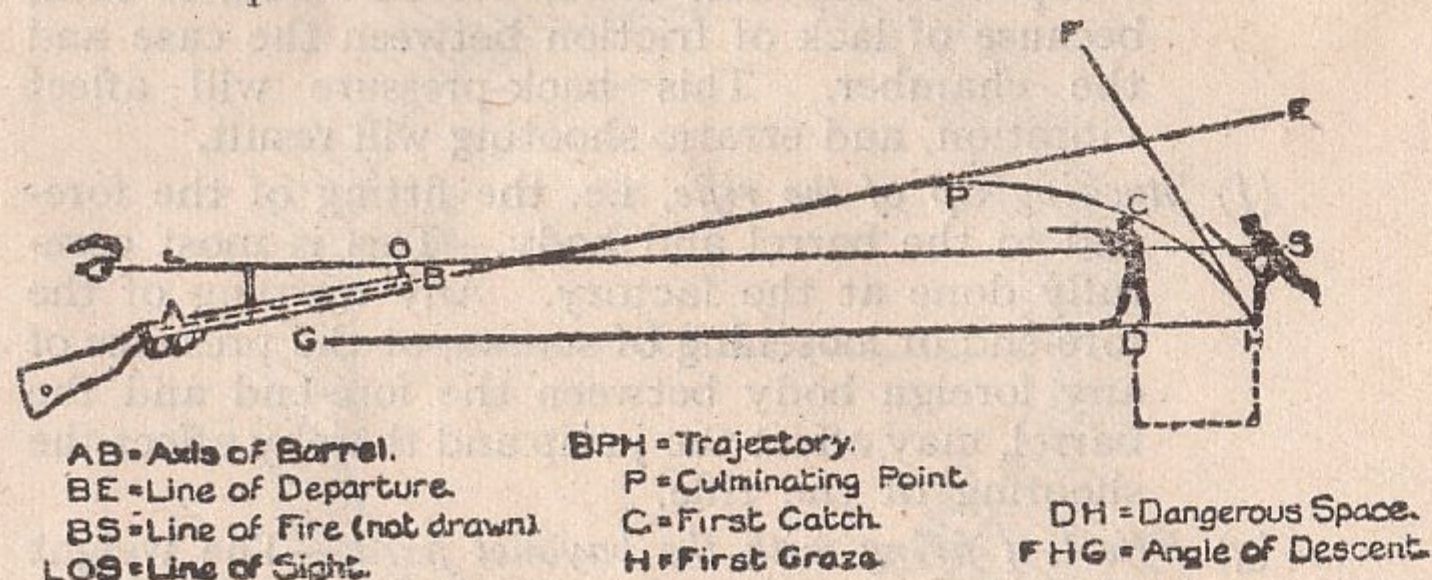


FIG. 2.

The line of sight is a straight line from the firer's eye, through the sights, to the point aimed at.

The trajectory is the curved path taken by a bullet during its flight (see Appendix IV).

The culminating point is the greatest height above the line of sight to which the bullet rises in its flight; this point occurs a little beyond half the distance which the bullet travels (see Appendix IV).

The angle of descent is the angle which the tangent to the trajectory makes with the line of sight at the point of impact.

Ricochets.—Bullets which rebound after striking the ground or any other obstacle and continue their flight are said to ricochet. Ricochets may occur from any surface, but are less likely from soft ground than from hard smooth surfaces; bullets ricochet freely from water, and from any surface may rise abruptly, or deviate considerably to right or left from their original course.

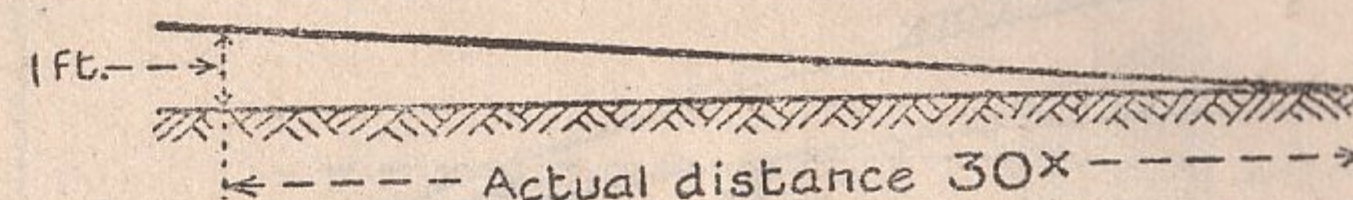
The first catch is the point where the bullet has descended sufficiently to strike the top of the target.

The first graze is the point where the bullet, if not interfered with, will first strike the ground.

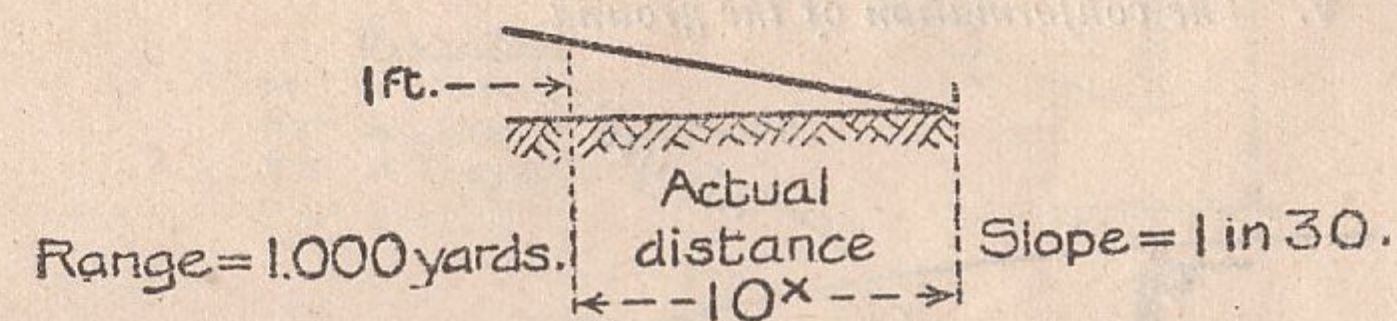
The dangerous space for any particular range is the distance between the first catch and the first graze. The extent of the dangerous space depends on:—

i. The range.

This diagram shows height increased six times.



Range = 600 yards. Slope of fall = 1 in 90.
∴ Dangerous space for prone man (1 ft. high) is approximately 30 yards.



Dangerous space is approximately 10x.

FIG. 3.

ii. The height of the weapon above the ground level.



FIG. 4.

iii. The height of the object fired at.

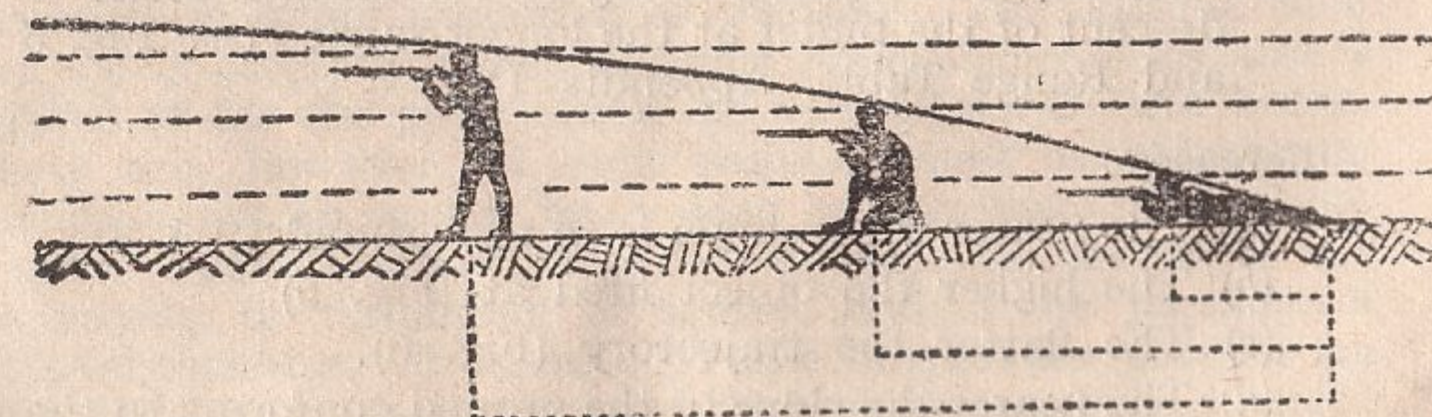


FIG. 5.

iv. The flatness of the trajectory.

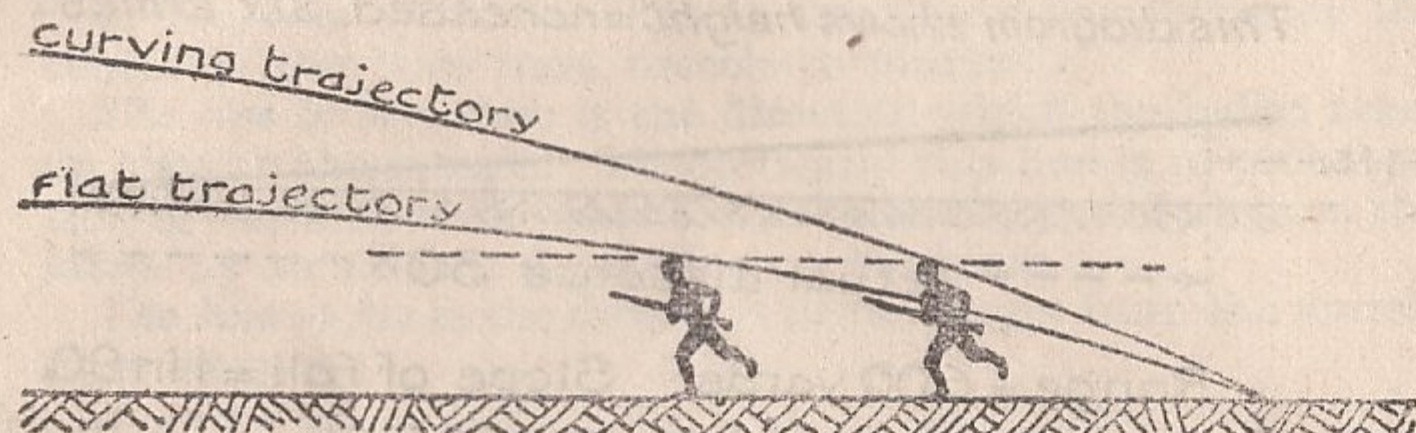


FIG. 6.

v. The conformation of the ground.

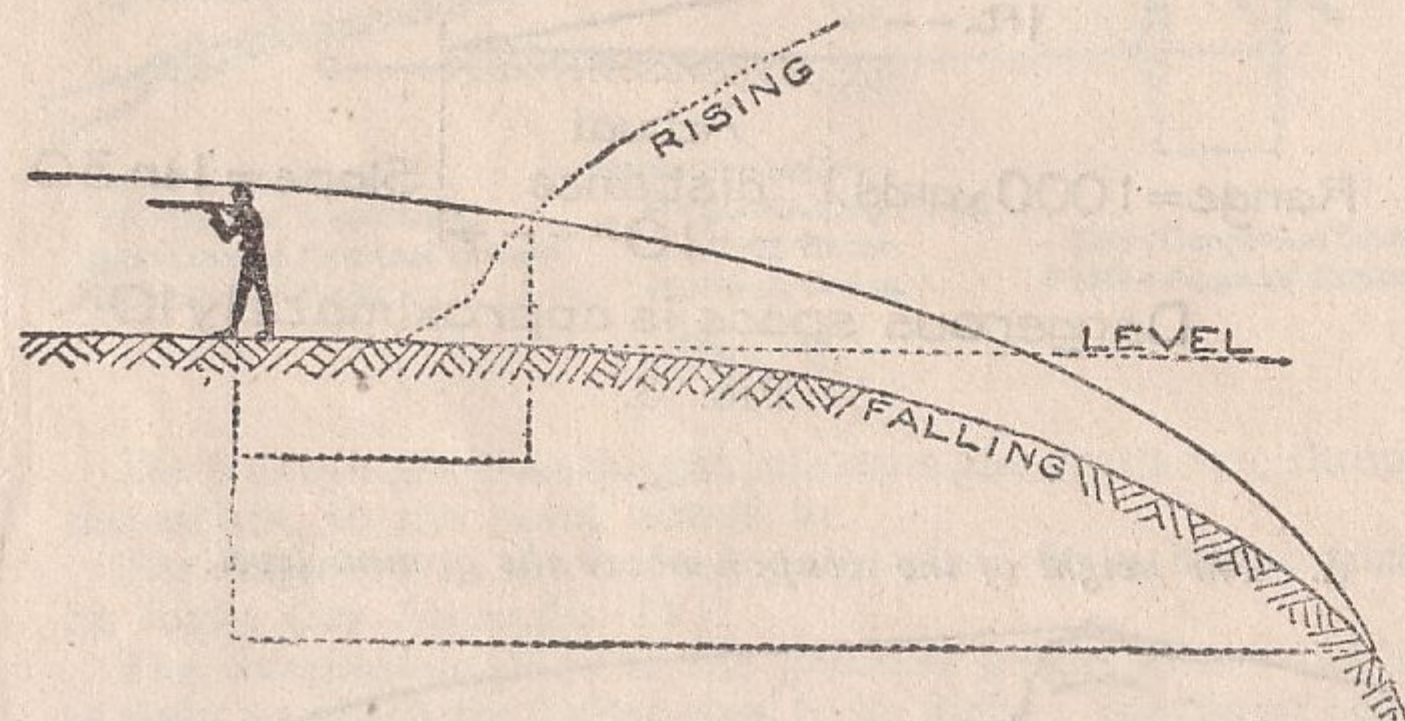


FIG. 7.

The dangerous space :—

decreases :

As the range increases, owing to the steeper angle of descent of the bullet at the longer ranges (see Fig. 3 and Range Table, Appendix IV);

increases :

- (a) The nearer the weapon is to the ground (Fig. 4).
- (b) The higher the object fired at (Fig. 5).
- (c) The flatter the trajectory (Fig. 6).
- (d) The nearer the slope of the ground conforms to the angle of descent of the bullet (Fig. 7).

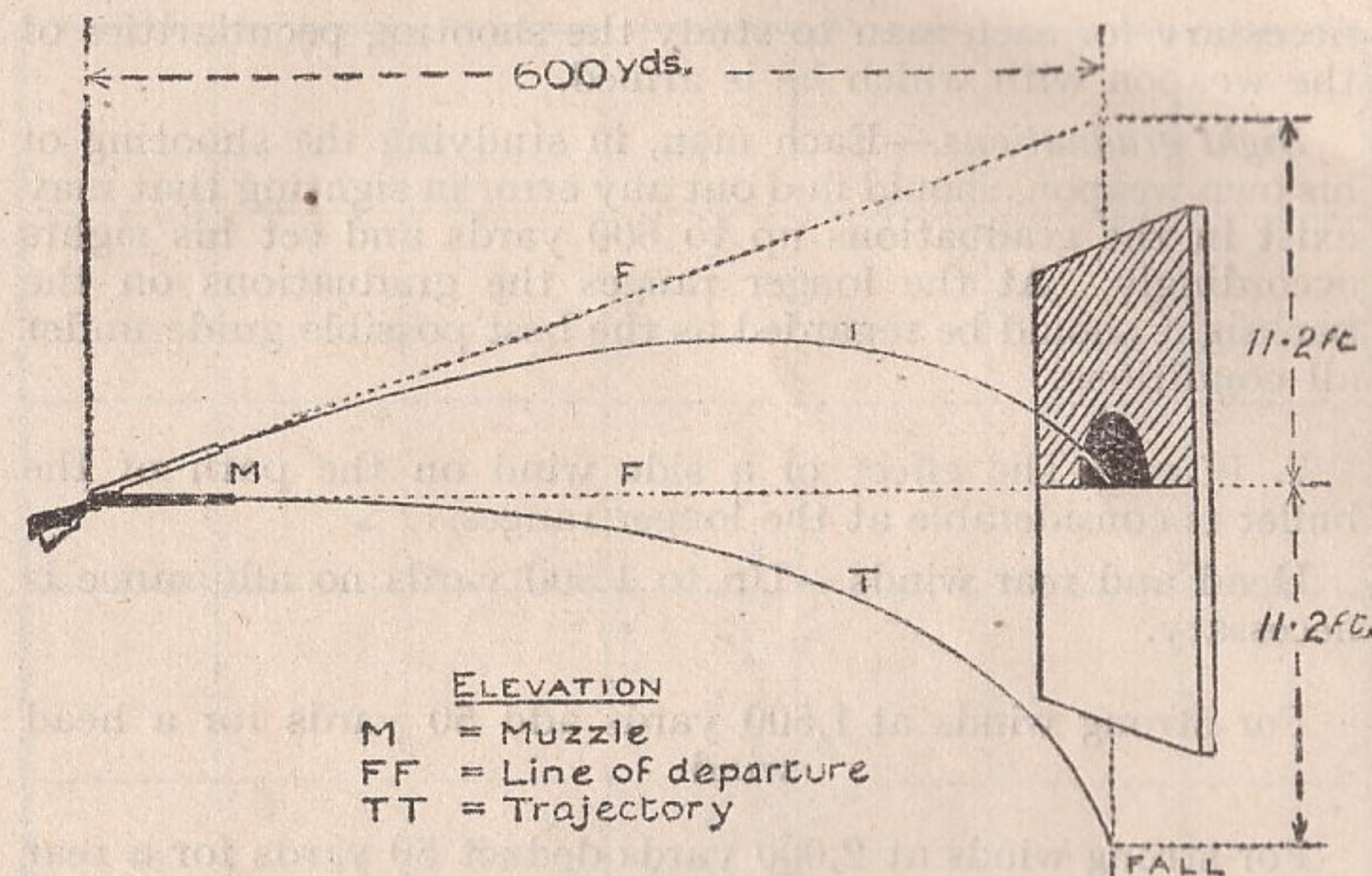


FIG. 8.

5. *Elevation.*—In order to allow for the fall of the bullet, it is necessary to direct the line of departure as much *above* the object to be hit as the bullet will fall *below* it if the axis of the barrel is pointed at the target. This raising of the barrel to allow for the curve of the trajectory is termed *giving elevation* (Fig. 8).

As the target must be kept in view, the weapon is provided with sights which permit the firer to give the elevation required without losing sight of the mark (see Appendix IV).

6. *Sighting of small arms weapons.*—In sighting, an average elevation for each range has been adopted. This means that the sight graduations of each weapon give the average elevation required by many thousands of weapons. In addition, each weapon is carefully tested at short range before issue and is sighted to hit the point aimed at, within certain close limits. There are, however, in each weapon small manufacturing variations which cannot be avoided in large-scale production. Further variations are produced by wear of parts, by the slackening or tightening of screws, and in the packing of Vickers machine gun barrels. These inequalities produce an individuality in each weapon which shows itself in a slight variation of the sighting elevation required; it is therefore

necessary for each man to study the shooting peculiarities of the weapon with which he is armed.

Sight graduations.—Each man, in studying the shooting of his own weapon, should find out any error in sighting that may exist in the graduations up to 600 yards and set his sights accordingly. At the longer ranges the graduations on the backsight should be regarded as the best possible guide under all conditions.

7. *Wind.*—The effect of a side wind on the path of the bullet is considerable at the longer ranges.

Head and rear winds.—Up to 1,500 yards no allowance is necessary.

For strong winds at 1,500 yards add 50 yards for a head wind.

For strong winds at 2,000 yards deduct 50 yards for a rear wind.

8. *Atmospheric conditions.*—The effect of atmospheric conditions other than wind need not normally be considered on active service. It is sufficient if it is realized that, in fighting at high altitudes, less elevation may be necessary. The variation will only be about 50 yards at 800 yards' range at a height of 4,000 feet.

Alterations of temperature need not be taken into consideration, except that, when cartridges have become heated in the sun, some rifles are liable to shoot high.

9. *Light.*—In bad light the foresight is less distinctly seen than in a good light, and more of it is unconsciously taken into the line of sight. This factor naturally affects the elevation used, less being required on a dull than on a bright day.

11. Elementary Theory (L.M.G.)

1. This section deals with theory in respect of a series of shots fired from a light machine gun.

2. When fire is delivered at a target, the bullets pass through the air in the shape of a *cone of fire*, which is the pattern formed by a series of shots fired with the same elevation and point of aim. This pattern is oval in shape, its density decreasing from the centre outwards (see Figs. 9 and 10).

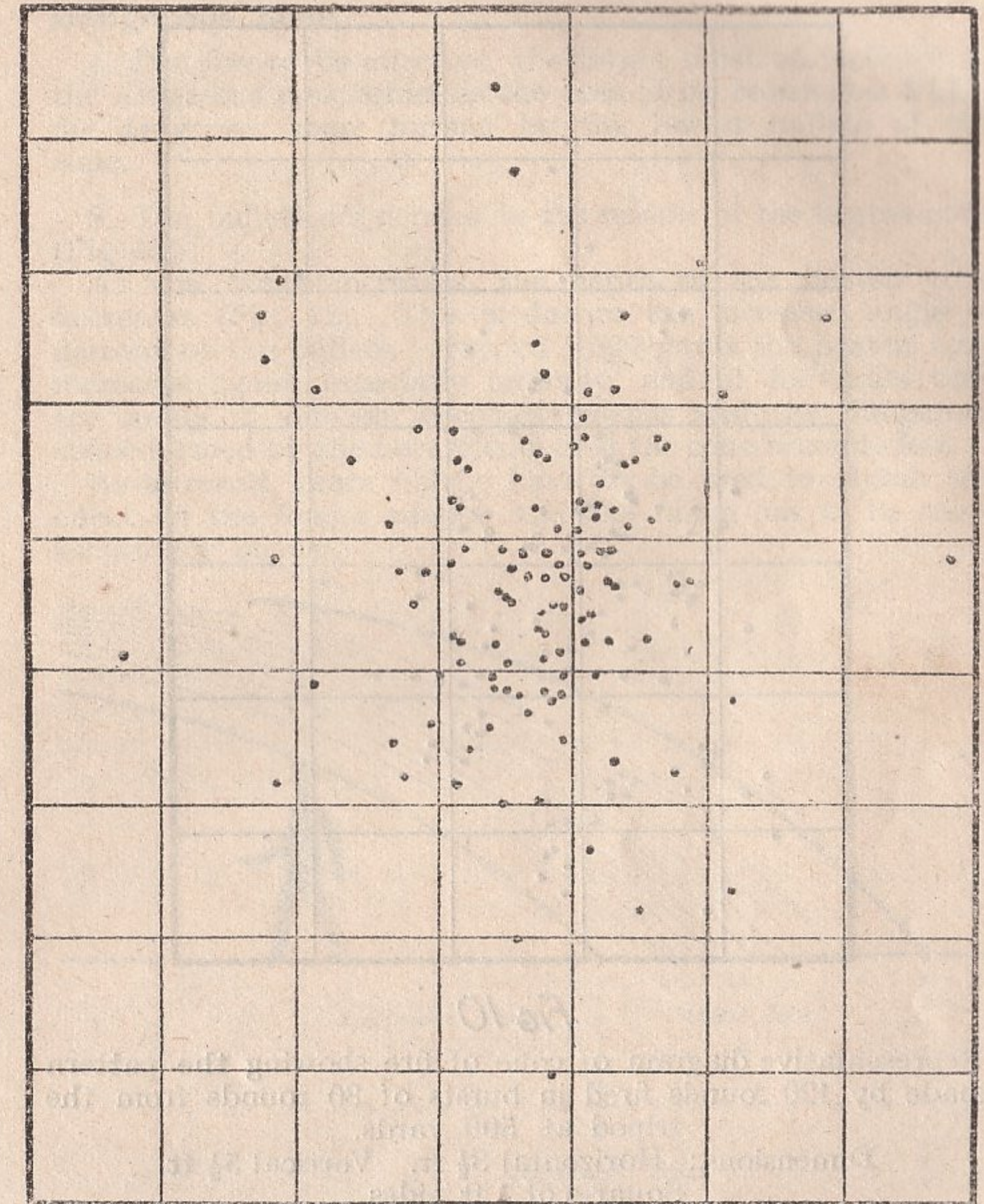


FIG 9

Diagram of a cone of fire showing the pattern made by 120 rounds fired in service bursts from the bipod at 500 yards.

Dimensions: Horizontal $6\frac{1}{2}$ ft. Vertical $7\frac{1}{2}$ ft.

Squares of 1 ft. sides.

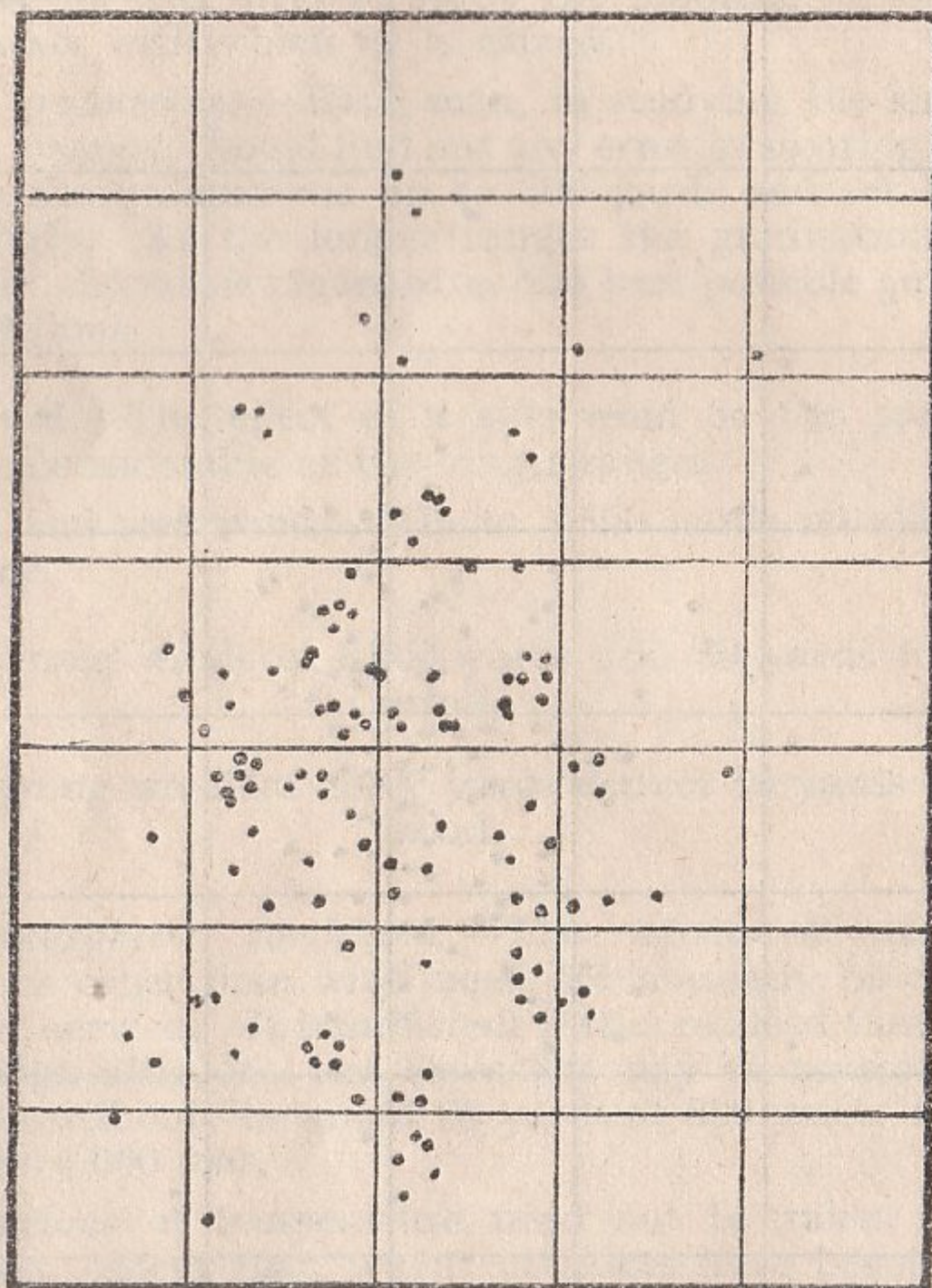


Fig 10

Representative diagram of cone of fire showing the pattern made by 120 rounds fired in bursts of 30 rounds from the tripod at 500 yards.

Dimensions: Horizontal $3\frac{1}{2}$ ft. Vertical $5\frac{1}{2}$ ft.
Squares of 1 ft. sides.

The cone of fire from a light machine gun is smaller than that formed by the fire of a number of riflemen, since the skill and eyesight of the men and the shooting of the rifles vary.

When fire is correctly applied to a target, the bullets of the cone on striking the ground form a *beaten zone* round the target.

3. The size of the *beaten zone* will vary with the range and slope of the ground in relation to the angle of descent of the bullets.

Dangerous Zone

4. For fire to be effective, the target must be included in the *dangerous zone*, which is the area of the *beaten zone* PLUS the *dangerous space* formed by the lowest bullets of the cone.

5. The bullets are densest in the middle of the beaten zone (Fig. 11).

As the range increases, the depth of the beaten zone decreases (Fig. 12). This is due to the increased angle of descent of the bullets. Beyond 1,500 yards the beaten zone increases again, especially laterally, and at the same time the angle of descent becomes steeper and the dangerous space formed by the lowest bullets of the cone becomes less.

As a result, more bullets have to be fired to obtain fire effect at the longer ranges, and the range has to be more accurately known.

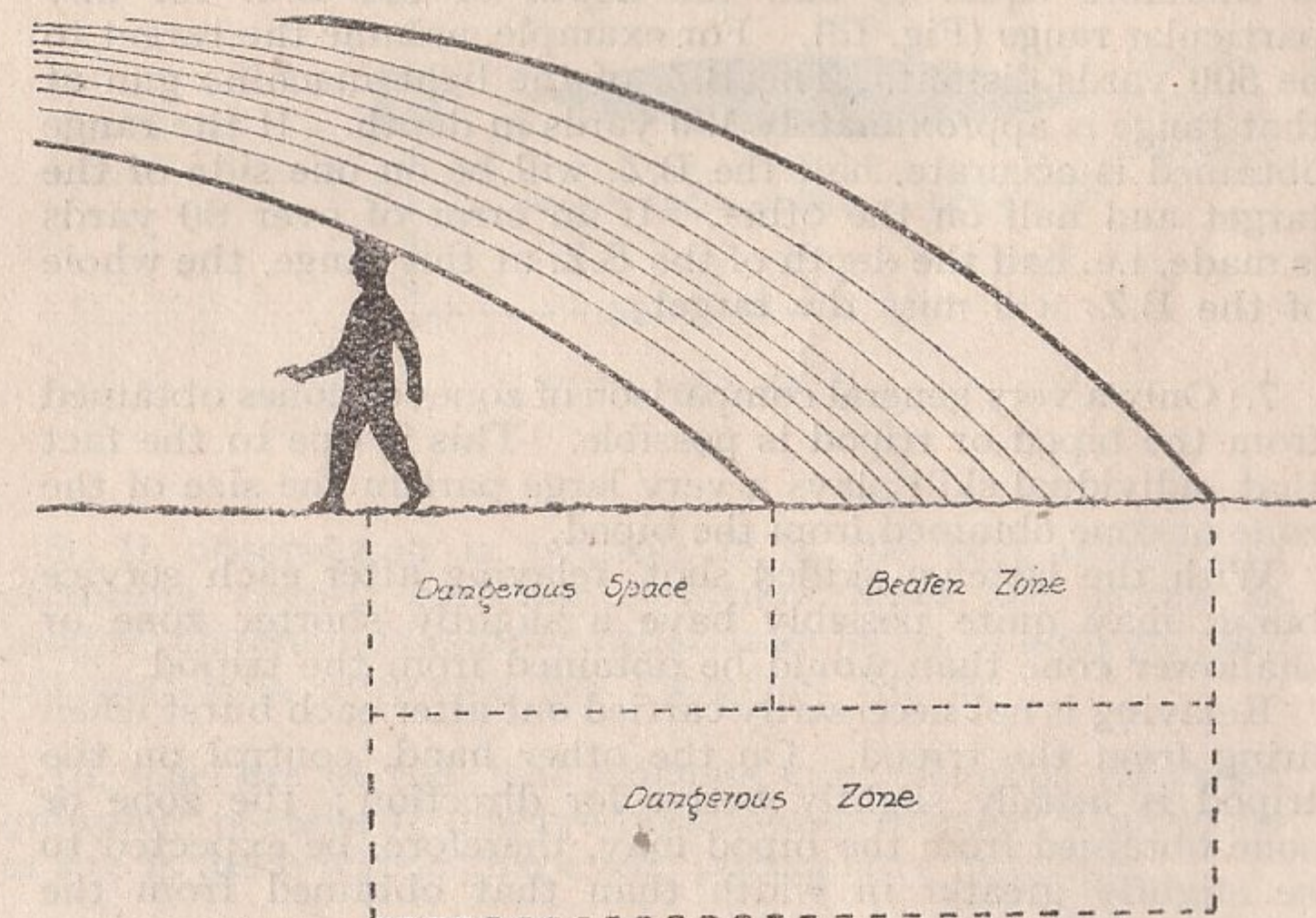


Fig. 11

Ranging

6. Ranging is the process of determining by observation of fire the direction and elevation required to hit a given target. The *permissible error* in ranging is the term applied to the error which can be made in estimating range while still keeping

Range B.Z.
500 yds 175 x 2 yds



1000 yds 115 x 4 yds



The above figures are based on
90% of rounds fired from the Bipod.

Fig 12

the target within the B.Z. The permissible error in ranging is therefore equal to half the depth of the B.Z. for any particular range (Fig. 13). For example, assume the target to be 500 yards distant. The B.Z. of the light machine gun at that range is approximately 180 yards in depth. If the range obtained is accurate, half the B.Z. will be on one side of the target and half on the other. If an error of over 90 yards is made, i.e. half the depth of the B.Z. at this range, the whole of the B.Z. will miss the target.

7. Only a very general comparison of zones or cones obtained from the bipod or tripod is possible. This is due to the fact that individual skill plays a very large part in the size of the zone or cone obtained from the bipod.

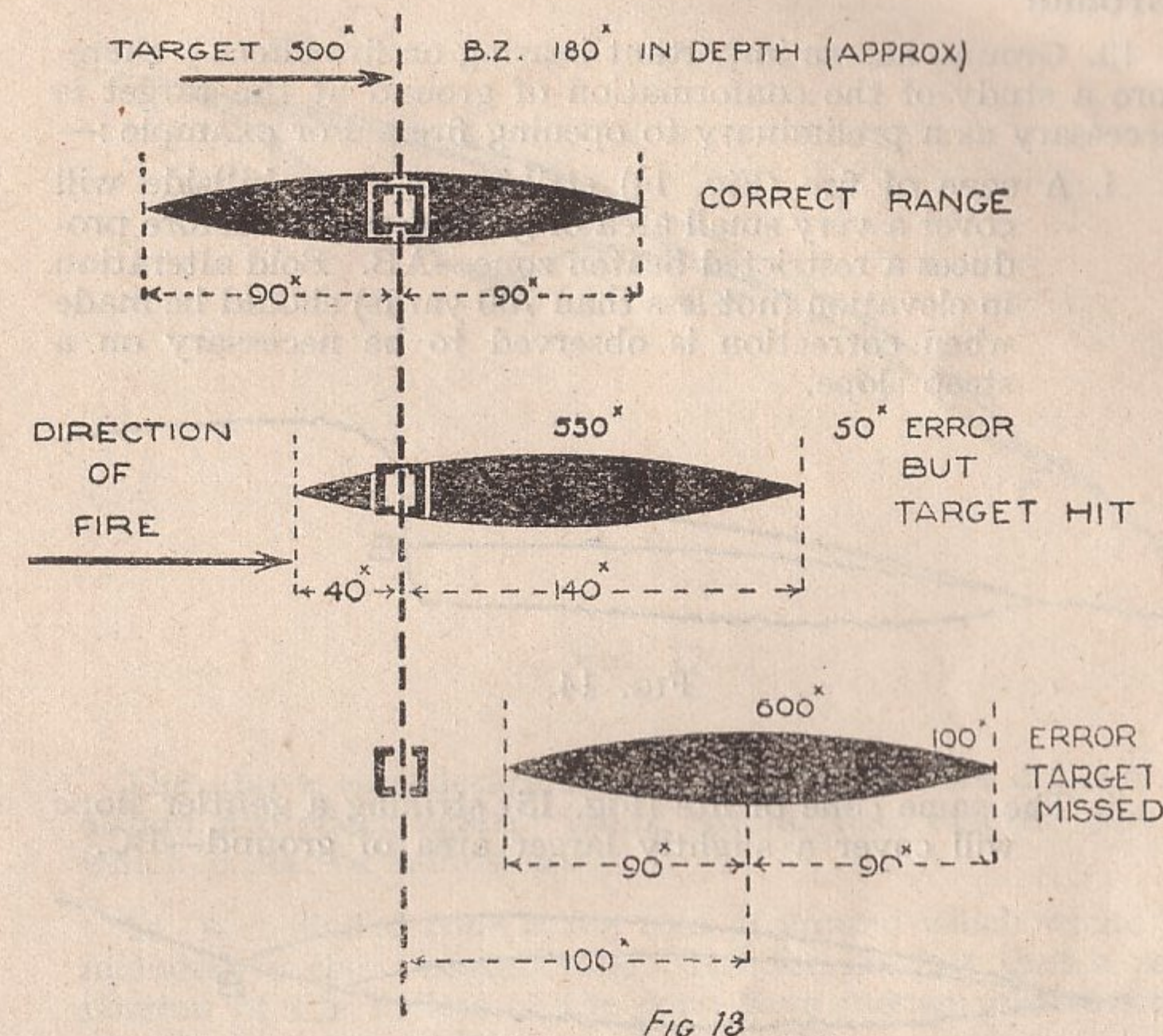
With the latter a skilled shot, relaying after each service burst, may quite possibly have a slightly shorter zone or shallower cone than would be obtained from the tripod.

Relaying is not necessarily carried out after each burst when firing from the tripod. On the other hand, control on the tripod is usually slightly better for direction; the zone or cone obtained from the bipod may, therefore, be expected to be slightly greater in width than that obtained from the tripod.

With semi-skilled or inexperienced firers it is probable that the zones or cones obtained from the bipod will exceed those from the tripod in depth as well as width.

8. Every opportunity should be taken of practising the observation of fire. The possibilities of observing fire will largely depend on the nature of the ground.

Full use should be made of the opportunities for practice which occur in battle shooting and field firing.



9. If observation is possible it is the best method of obtaining correct sighting elevation, since the errors in judging distance, caused by variation in light, ground, etc., are automatically overcome (see Pamphlet No. 2).

10. The fire of the light machine gun, owing to its closer grouping, is easier to observe than that of riflemen, whose cone of fire is more widely dispersed, particularly in battle.

11. It must be remembered that a cone of fire, by whatever weapon it is produced, has a few wide shots round its edge.

The observation of the strike of single bullets must not, therefore, be taken as an indication of the centre of the beaten zone; rather the reverse since, if the ground shows the strike of one bullet, it will show more if they are there.

12. If the fall of bullets, both short of and beyond the target, is observed, it is safe to assume that ranging is correct.

Ground

13. Ground has an important bearing on fire effect ; therefore a study of the conformation of ground at the target is necessary as a preliminary to opening fire. For example :—

- i. A cone of fire (Fig. 14) striking a steep hillside will cover a very small area of ground, and therefore produces a restricted beaten zone—AB. Bold alteration in elevation (not less than 100 yards) should be made when correction is observed to be necessary on a steep slope.

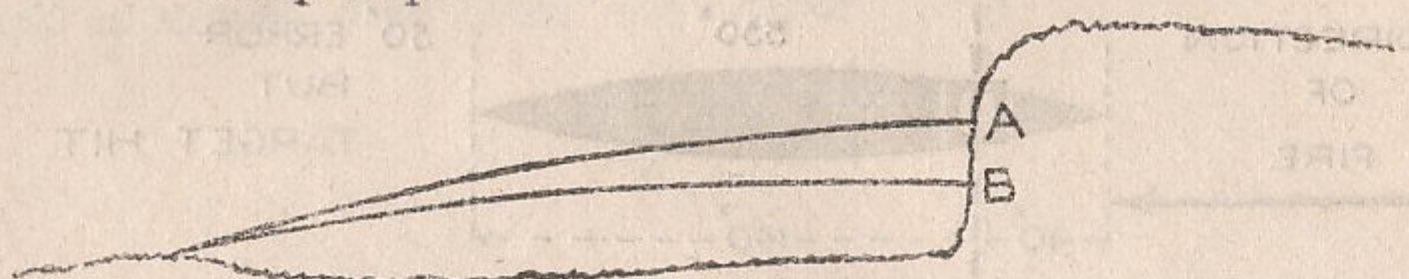


FIG. 14.

- ii. The same cone of fire (Fig. 15) striking a gentler slope will cover a slightly larger area of ground—BC.

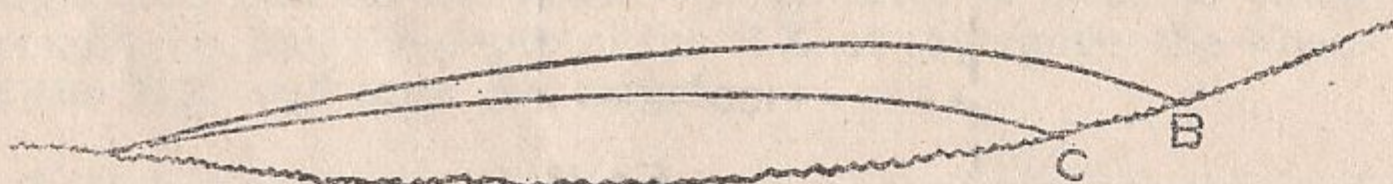


FIG. 15.

- iii. In similar proportion on level ground—DE (Fig. 16).

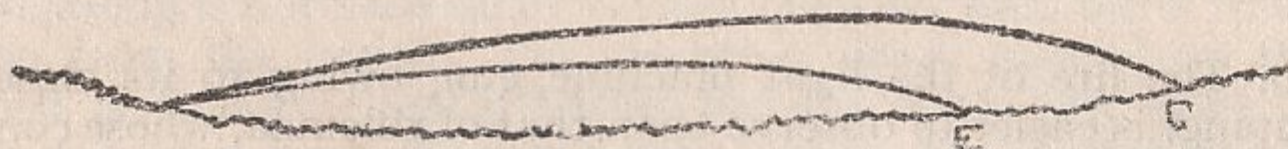


FIG. 16.

- iv. The greatest area swept by bullets will be where the fall of the ground conforms to the trajectory of the bullets, for example—a reverse slope (Fig. 17), in which case the whole area FG is a dangerous zone, of which FH is the beaten zone. Troops, even though under cover from view at K, would be in danger from un-aimed fire from A.

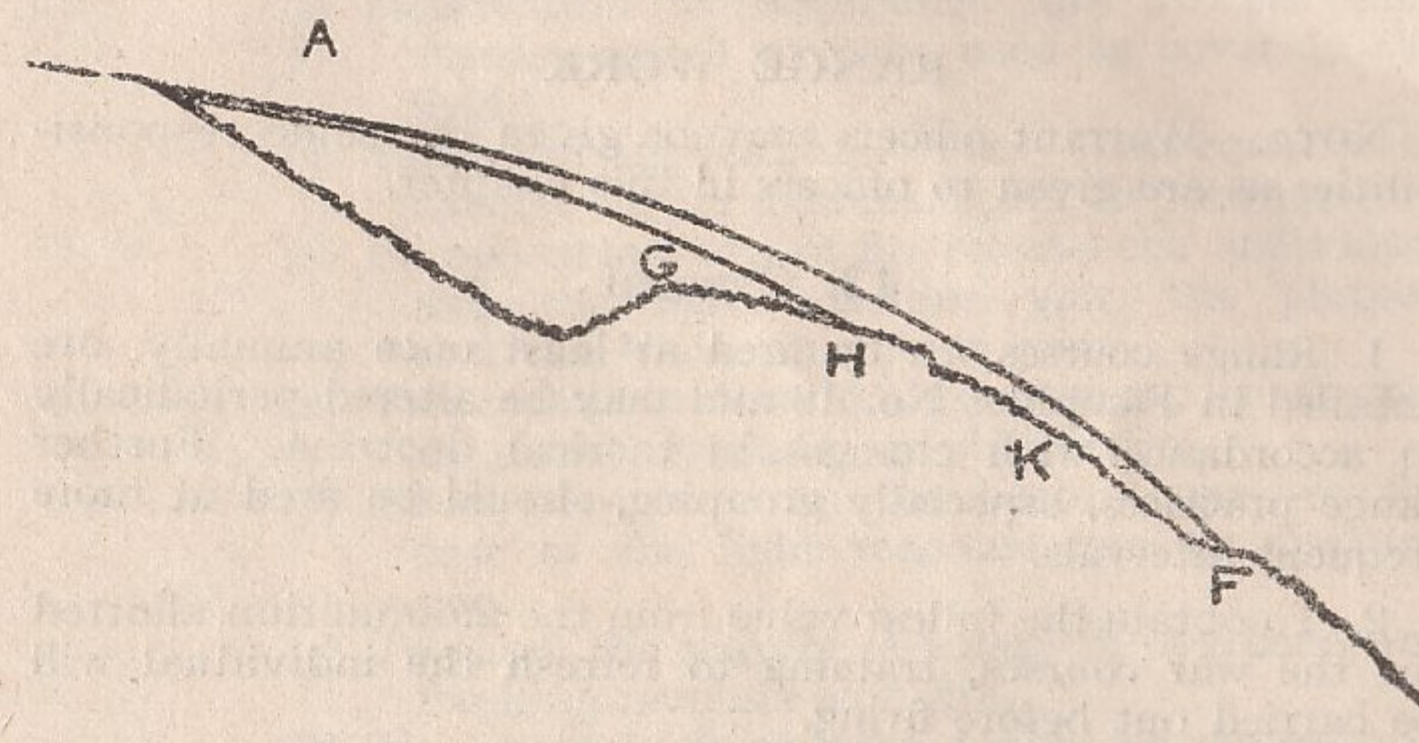


FIG. 17.

The above considerations show that it is more difficult to obtain fire effect against rising ground than against ground which is flat or falling away.

14. A defiladed zone is the area of ground which would be included in the "beaten zone," but for the fact that a proportion of the bullets of the cone have met an obstruction, usually a piece of high ground (Fig. 18).

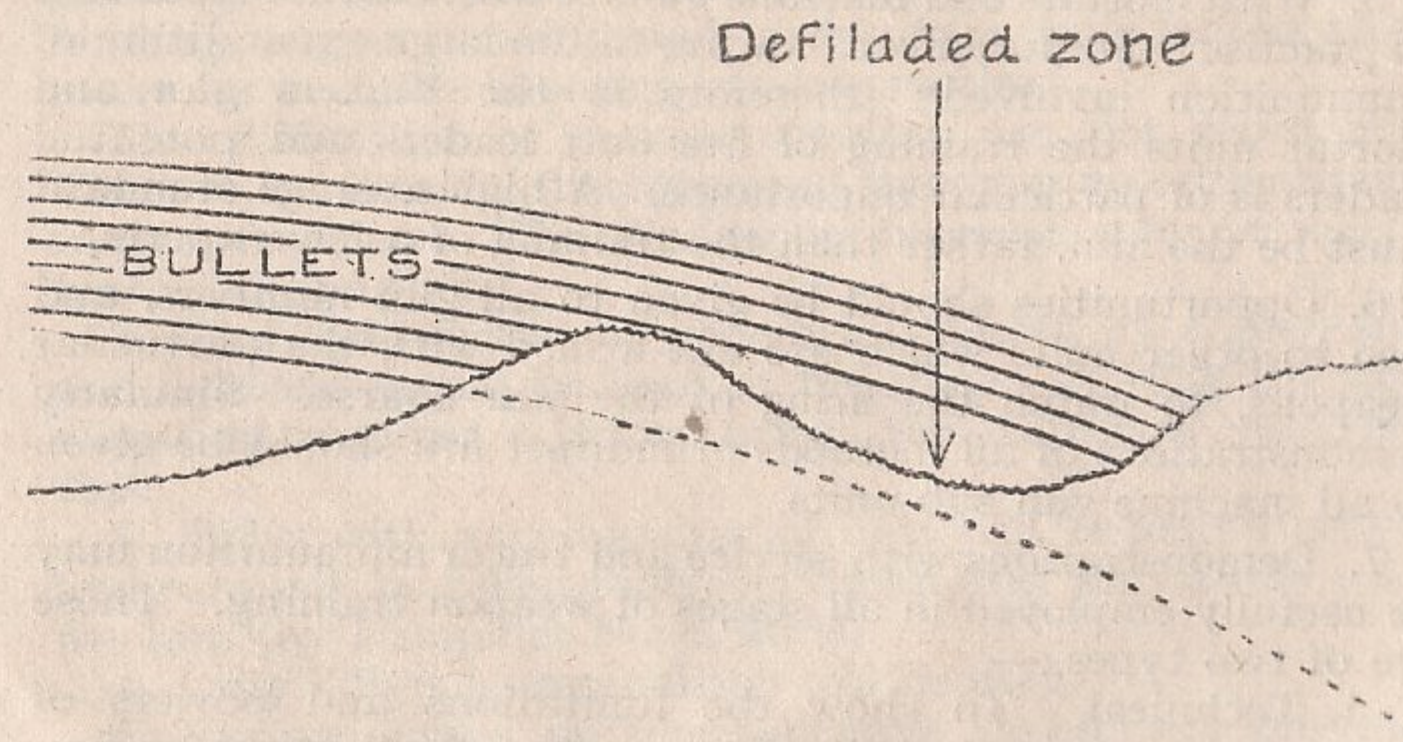


FIG. 18.

CHAPTER III

RANGE WORK

NOTE.—Warrant officers may be given the same responsibilities as are given to officers in this chapter.

12. General

1. Range courses, to be fired at least once annually, are detailed in Pamphlet No. 18 and may be altered periodically in accordance with changes in tactical doctrine. Further range practices, especially grouping, should be fired at more frequent intervals.

2. To obtain the fullest value from the ammunition allotted for the war courses, training to refresh the individual will be carried out before firing.

3. Before the war course is fired, it is essential that the sighting of weapons should be true for direction and elevation. The correction of errors of this nature is termed zeroing. (See Appendix I.)

4. Good coaching at the firing point is necessary in order to train the recruit to become an efficient shot and to improve the shooting of trained soldiers (see Appendix II). All N.C.Os. will receive instruction in this subject. Recruits and trained soldiers will be coached in all practices, except where otherwise stated, in order that they may obtain good results and thereby improve their shooting through confidence.

5. With mortars and machine guns it will seldom be possible to practise "fire for effect" owing to the large expenditure of ammunition involved; therefore in the Vickers gun and mortar units the training of fire unit leaders and potential leaders is of particular importance. A high average standard must be the aim, rather than the training of a few experts.

6. Opportunities should be given to all gun numbers, and also to other units which are not armed with the particular weapons, to watch the firing of the war course. Similarly demonstrations of all methods of indirect fire should be given to all machine gun sub-units.

7. Demonstrations with service and tracer ammunition may be usefully employed in all stages of weapon training. These are of two types:—

i. Technical. To show the limitations and powers of weapons and their effect on the application of fire. The following are some examples:—

(a) Elementary theory, showing trajectory, effect of wind, elevation, cones of fire, length of beaten zone.

(b) Penetration of the bullet into various substances which may be used as cover in the field.

(c) System of application of fire. (This can also be carried out on miniature and 30-yard ranges.)

(d) Comparative tests of fire effect—the individual and the light machine gun, the platoon and the Vickers machine gun.

(e) Vulnerability of various formations, as affected by direct, enfilade, or oblique fire.

(f) Effect of ground on the beaten zone—in the case of the light machine gun or machine gun.

(g) To show the margin of safety in overhead and flanking machine gun fire.

Of the above, (a) is suitable during recruit training and should be fired on the classification range; (b) and (c) should be given in the early stages of the training of fire unit leaders and should precede field firing.

ii. Tactical. To show the practical application of fire to a given tactical situation, illustrating methods of fire direction and control.

13. Miniature ranges

1. Miniature ranges are most suitable for the early rifle training of the recruit, where elementary lessons in aiming, holding, trigger pressing, and many of the main factors which make for accurate shooting can be practised.

The difficulties of service shooting are not reproduced. There is no shock of discharge and there are no estimations of range, wind, etc. The windgauge, however, may be used to teach "aiming off."

2. Each rifle should be periodically tested by a good shot, and a board should be kept in the range, showing the exact elevation required. Before firing, the instructor will check this.

3. Rifles with varying sizes of butt will be kept available, and care will be taken that every man fires with a rifle which fits him (see Pamphlet No. 3, Rifle).

4. Only .22-inch ammunition will be used.

5. Various types of representative targets are provided, and these are shown in S.A.T., Vol. V.

6. Practice should begin as soon as the recruit can adopt the lying position, aim, and press the trigger correctly. It should also form part of the preliminary training which precedes range courses.

7. Practices should conform to those fired later with service ammunition. Battle shooting can be carried out on miniature battle shooting ranges.

8. Scoring will be similar to that laid down for classification ranges (*see* Section 20). Groups will be measured with wire rings, one, two, and three inches in diameter. Recruits must reach a 3-inch standard.

9. Targets should be examined after each detail. Spotting may be carried out from the firing point by means of field glasses. Range discipline will conform, as far as possible, to that on the classification range.

14. 30-yard ranges

1. 30-yard ranges are generally near barracks and may be used all the year round. They have certain advantages over miniature ranges. The man uses his own rifle or section weapon and becomes accustomed to the shock of discharge and the noise of the firing.

2. Discipline will conform as far as possible to that in use on the open range.

3. Where convenient, bayonet assault courses will be provided behind the firing points.

4. In rifle practices, groups will be measured as in para. 8, above. For L.M.G. practices rings measuring two, three, and four inches in diameter will be used. For M.G. practices rectangles measuring two inches by four inches and four inches by six inches will be used.

15. Classification ranges

1. Shooting at service distances is carried out on the classification range. It will be used for the firing of range courses, including battle shooting for the training of the individual as a preliminary to field firing, which exercises the fire unit.

2. *Range orders.*—The officer who approves the range will issue safety orders for the range. Copies of the orders will be posted in the butts and will be issued to all units in the station concerned. Attention will be given in particular to safety precautions for anti-aircraft practices and for 30-yard ranges.

3. *War courses.*—The detail of the war range courses is laid down in Pamphlet No. 18, and will be fired by all ranks other than those exempted by the pamphlet.

As far as possible, all men on the strength of companies should be made available to fire with their company. Those

unable to do so will be formed into a party of "casuals" to fire the course.

Soldiers serving away from their own unit will fire with the unit to which they are attached.

Practices should be fired in the order in which they appear in the tables. Rapid practices should be fired immediately after the deliberate practice at the same range. Ranging, application, and distribution practices should be fired consecutively without leaving the firing point.

4. *Dress.*—In all practices battle order will be worn.

5. *Supervision.*—During range practice, an officer will normally supervise at all times at the firing point, but in exceptional circumstances where no officer is available C.Os. may give authority for supervision by warrant officers. Duties in the butts may be carried out by N.C.Os. if sufficient officers are not available.

6. *Range discipline.*—To avoid delay, a simple system of issuing ammunition and of ensuring that details next to fire are ready will be devised by units in accordance with the following general instructions:—

- i. There should be an instructor for each firer.
- ii. A N.C.O. or man should be detailed as telephone orderly.
- iii. A N.C.O. should be responsible for the issue of ammunition and collection of empty cases and live rounds.
- iv. In grouping practices, two details should fire and then proceed to the targets to see their groups measured and to note the position of their M.P.I. If it is not practicable to send the firers up to the targets, the results may be signalled (*see* page 38).
- v. In snapshooting practices, the timed exposures of the target will be controlled by the officer on butt duty. The exposure will be reckoned from the time when the target is in position and stationary to the moment when it is again moved for lowering.

In rapid practices, the time will normally be regulated from the butts. On these occasions the actual fire order by the officer superintending at the firing point will be in anticipation of the targets appearing. This officer will inform the officer in the butts when the detail is ready. Where the normal procedure cannot be adopted, the targets will be exposed before the practice begins and the timing will be carried out at the firing point.

- vi. *Occasional shots.*—Occasional shots to verify elevation or strength of wind, or the accuracy of the weapon,

may sometimes be fired by an officer or N.C.O., with the senior officer's permission. Notification of their beginning and end will be made to the officer in the butts. The target in use will be lowered and checked and a clean one raised for the occasional shots. When they are completed, it will be lowered and checked, and the original target will be raised for the firer to complete his rounds.

16. Allowances and penalties

1. i. The use of the windgauge and sling is prohibited.
- ii. No sighting shots are allowed, unless provided for in the practice.
- iii. The fine adjustment may be used in any practice.
- iv. Allowance for jams and misfires:—
 - (a) If a jam or stoppage, due to breakage or a defect in mechanism, occurs, and is not caused by any fault of the firer, the time allowed for the practice will be increased to the extent due to the delay thereby resulting. Should a jam or stoppage occur in a rapid practice, through a defect which cannot be quickly rectified, the whole practice will be repeated.
 - (b) In the event of misfires, provided that the superintending officer is satisfied that the cap of each cartridge has been struck, extra rounds will be allowed equal to the number of misfires which occur in the practice concerned, a proportionate part of the time allowed for the whole practice being given for each extra round. With the pistol the round will be tried in another pistol.
 - (c) In fire with movement practices no allowance will be made for jams or misfires.
- v. Forfeiture of rounds.—Omission to fire the rounds allotted, or failure to fire during an exposure, will entail forfeiture of the rounds which should have been fired, and misses will be recorded for them.
- vi. For every shot fired after the order or signal to cease fire has been given, the value of the highest hit obtainable by a single shot will be deducted.
- vii. In machine-gun practices, belts and magazines will be filled by the firers who are to use them. Opportunity will be given to the firer, before he begins any practice, to inspect the gun and ammunition which he is to fire.
- viii. Short bursts in firing the L.M.G. and M.G. will be discouraged.

17. Field firing

1. Field firing ranges

i. Exercises with ball ammunition on the field firing range are the culmination of weapon training. The field firing range provides conditions most nearly akin to war, and all shooting on other ranges will be regarded merely as a means to obtain efficiency in this final test. The capabilities of companies may here be judged far better than by the results obtained on classification practices, or in competitions, where conditions are mainly artificial.

Officers responsible will visit the range and prepare the practices, having regard to the lessons to be taught, target facilities, safety precautions, and ammunition available. The value of the exercise will depend on sound preparation, clear explanation to those taking part, and a well-conducted criticism at the conclusion. Simple problems should be so designed that all actions of the fire unit are such as would be possible and likely in war.

ii. The siting and exposure of targets, and methods of checking them, will be arranged. Markers will always be rehearsed in their duties. (For targets and appliances, see Vol. V.)

iii. Officers or N.C.Os. will be detailed to each fire unit to watch its tactical handling and must conform to its movements. They will be responsible to the officer superintending for safety precautions, but, apart from ensuring that these are observed, they will not interfere with the actions of firers or leaders.

They must also have carried out a reconnaissance on the ground.

iv. Targets will be provided for each firer or fire unit and will be checked after a practice, and the percentage of hits to rounds fired, or in distributed fire the percentage loss inflicted on the enemy, will be recorded. Falling plates and collapsible targets add interest. Figure targets should be arranged to resemble formations likely to be used by the enemy, and should be realistic.

v. Fire units will not be exercised in engaging targets at distances exceeding 1,000 yards, except in the case of carrier platoons, and M.M.Gs.

vi. Where a field firing range is not available, suitable land may be taken under Defence Regulations 51 or 52. Attention is drawn to "Notes on the use of Land for Training, 1942."

All civilians living in the proximity of the field firing area should be warned when field firing is going to be carried out. This can probably be done best through the local police. The fact that this warning has been given does not do away with the necessity for sentries being posted to prevent people entering the danger area.

vii. A convenient method of discussion at the conclusion of the practice is as follows :—

The individual or fire unit commander states the information and orders which he received, his action, and the reasons for it.

The officer or N.C.O. watching the practice states his views.

The superintending officer, in summing up, after stating the factors affecting the situation and the alternatives, gives his opinion as to the correct action to be taken, bringing out the chief lesson of the exercise.

viii. *Greater value for the ammunition expended will sometimes be obtained by a rehearsal without ammunition.*

ix. Vickers machine gun units will generally concentrate at stations where ample facilities for field firing exist. The nature of the practices to be carried out will be settled by the divisional commanders concerned.

As a general guide, fire control and discipline and observation should be practised by the personnel of all platoons as under before tactical exercises are carried out.

<i>Nature of exercise</i>	<i>Personnel to practise and receive instruction</i>
(a) Fire control—direct.	{ All N.C.Os. and potential N.C.Os.
(b) Fire control—indirect. Day and night.	
(c) Fire discipline—direct.	Troopers and privates.
(d) Fire discipline—indirect. Day and night.	{ Junior N.C.Os. and privates.
(e) Observation of strike (including use of field glasses).	
(f) Duties of range-takers during firing.	{ Range-takers.
(g) Maintenance of sustained fire (stoppages should be included in all belts, except for demonstrations).	
	Troopers and privates.

x. *Records.*—Company commanders will keep records of all practices fired, with details of results. (See Sec. 22, para. 1.)

xi. *Combined exercises.*—Combined exercises with ball ammunition will be carried out to practise the co-operation of all arms in battle.

2. *Use of live ammunition for simulating battle conditions*

The following rules will be observed when live ammunition is fired in the vicinity of troops with a view to accustoming them to battle conditions :—

i. All firing of live ammunition will be controlled by an officer or a warrant officer or senior N.C.O.

ii. Single rounds or short bursts only will be fired.

iii. The firer will only use :—

(a) A weapon he knows thoroughly.

(b) A weapon that has been correctly zeroed.

All firers will be especially selected for their marksmanship in the particular weapon being used.

iv. Before opening fire, the firer must appreciate both the ground at the selected point of impact of the bullet or bomb and the ground beyond the point of impact.

v. *The ground selected for the point of impact should, if possible, be of a type unlikely to cause ricochets. In any case fire will never be put down between the firer and the troops.* The point of impact will be well to the flank, in line with or beyond the troops. This minimizes the possibility of a ricochet. Ricochets may deviate 45 degrees or more from the point of impact.

vi. For the purpose of this training, bullets which pass five yards over the heads of the troops have the same psychological effect as if they only passed five feet overhead. Therefore, a wide safety margin can be allowed without deterioration in the value of the training given. The overhead safety margin will never be less than five yards; it should usually be more. The greater the range the wider the safety margin should be. Overhead fire will not be attempted for training purposes at ranges over 500 yards. *Overhead fire should always be given from the tripod.*

vii. If there is any doubt as to the safety of either troops or civilians, do not fire.

viii. No person, other than those detailed to use live ammunition, will carry or use it.

ix. The firer must be completely in the picture as regards

all possible methods of approach of the troops. This is of increasing importance in view of developments in individual camouflage. The firer will not fire if he cannot see the troops.

- x. Sentries must be posted to prevent people entering the danger area.

18. Safety precautions (all ranges)

1. i. Firing will not take place until the danger flags are hoisted and look-out men posted according to the by-laws and standing orders.

ii. A red danger flag will be hoisted at the butts as a warning to cease fire. The flag will be kept up until the whole of the butt party is under cover. No one will leave the butts until the cessation of fire has been notified from the firing point. When cessation of fire is required, the superintending officer at the firing point will normally give the order.

iii. A red flag will be hoisted at the firing point when no firing is taking place. It will always be hoisted when the danger flag is flying at the butts.

iv. Weapons will be pointed towards the butts during inspection, and when loading or unloading takes place.

v. No one, except the firers, the instructors, and the officers on duty, will be allowed on the firing point.

vi. If firing is suspended during a practice, or whenever the danger flag is hoisted at the butts, safety catches will be applied, rifles will be laid on their side, locks of Vickers machine guns will be removed from the lock guides, magazines will be removed from light machine guns, weapons on the firing point will not be touched, and firers will stand up.

Light machine guns will be unloaded without firing the round in the chamber. Anti-tank rifles will be unloaded.

vii. After firing, live rounds will be separated from empty cases and collected, under the orders of the superintending officer.

viii. An officer will inspect all weapons, magazines and equipment before they are removed from the firing point, to ensure that they are unloaded and that the men are not in possession of ammunition. A further inspection will take place before the company or party leaves the range.

ix. Repairs and replacements will not be carried out until a gun is clear. No one except the gun numbers authorized to be on the firing point by the conditions of the practice will be permitted to touch the gun without permission when a stoppage occurs.

x. No weapon will be loaded without orders from the superintending officer.

xi. Drill cartridges will not be taken on the range, except for use in stoppage practices. In this instance the drill cartridges will be taken to and from the range under the orders of the company, etc., commander.

xii. Pistols will be kept in the case until actually required for use. When out of the case, they will be carried at the rest position.

xiii. Indiscriminate snapping is forbidden.

xiv. After firing with the pistol, the officer in charge will give the order "**Unload**". No one will be allowed to move towards the target until the officer in charge gives an order to that effect.

xv. In anti-aircraft practices, unless the danger zone extends to a depth of 3,500 yards behind the stop-butt, the siting of targets and weapons must be so fixed that all bullets are caught in the stop-butt. In traversing practices, targets must be so sited that the line of fire is within the width of the danger area (see S.A.T., Vol. V).

xvi. When firing at night takes place, special precautions for safety must be taken. Firing will take place only from that part of the range which gives the greatest safety margin against oblique fire. A target directly to the front of the firer only will be engaged. In firing on fixed lines, these will be laid out in daylight. Fire, if possible, will be from a trench or weapon pit, and no target over 200 yards' distance should be engaged, except in firing on fixed lines.

Red lamps will be used at the firing point and in the butts or target pits in substitution for red flags. Before a lamp is taken in or first exposed, it will be swung to and fro to attract attention; this will ensure that the lamp has not been accidentally extinguished.

2. Additional precautions for miniature and 30-yard ranges :—

Miniature range.—When it is necessary to examine targets, rifles will be unloaded and laid on the firing point with the breech open, and the red flag will be raised before anyone goes to the target.

30-yards range.—

i. No more than six rifles, or four anti-tank rifles, or four machine guns will be fired at the same time on a 30-yards range of standard width (24 feet).

The anti-tank rifle will be fired only if the range has been specially passed for the purpose.

- ii. During the firing of machine gun practices, the superintending officer may make special arrangements to call those waiting to fire up to a position from which they can hear the instruction and criticism, but even then they must be at least five yards in rear of the firer.
- iii. No target will be placed within four feet of the sides of the bullet catcher.
- iv. Representative targets and pistol targets will be placed at the bottom of the bullet catcher.
- v. Landscape targets will be so placed that the skyscreen is at the bottom of the bullet catcher and the picture below it.
- vi. Anti-aircraft targets, .22-inch, will be so placed that the line of fire is directed into the bullet catcher.

3. *Accidents caused by explosions.*—Should an explosion cause damage to a weapon, the weapon and batch of ammunition concerned will be preserved intact, and a report of the occurrence forwarded through the usual channels to the Chief Inspector of Small Arms.

19. Duties of superintending officers

- 1. Officers will not superintend more than eight targets on the firing point and in the butts.
- 2. The duties of officers superintending at the firing point are :—
 - i. To ensure that the regulations for safety and for the conduct of the practices are obeyed and, where ranges adjoin, that the minimum safety angle is observed according to standing orders.
 - ii. To ensure that no more than the authorized amount of ammunition is expended by each firer.
 - iii. To ascertain that only such coaching as is permitted by regulations is allowed.
 - iv. To allow each detail one or two "snaps" at the target before loading. No aiming or snapping will take place, except from the firing point.
 - v. To ensure that, where applicable, service bursts of four or five rounds are fired in light machine-gun practices.
 - vi. To see that rifles are in the correct positions before beginning practices.
 - vii. In battle shooting practices, when applicable, to see that the correct use is made of cover.
 - viii. To check that the marking in the butts is carried out according to the regulations, and that firers are given an opportunity to see the marking and of entering the results in their record books.

- ix. To collect, check, and sign the registers, and forward them, together with the firing point registers, to the headquarters of the unit concerned.
- 3. The duties of officers superintending at the butts are :—
 - i. To see that the targets are of the proper dimensions and sufficiently clean to enable shot holes to be distinguished easily, and that all old shot holes are properly patched before practice begins.
 - ii. To see that the butts and appliances are in good order and to report any damage or deficiency.
 - iii. To explain all regulations and local orders to the markers, and to ensure their observance.
 - iv. To allow no man to leave the butts without an order. This order will not be given until it has been ascertained personally that the red flag has been hoisted both at the butts and at the firing point. To prevent the red flag being lowered until satisfied that all markers are in the butts.
 - v. To detail markers to targets. In grouping practices, one marker at each target should be responsible for noting the order in which shots strike the target and, during other practices, for watching the bank.
 - vi. To see that the targets for machine guns, if placed on the stop-butts, are erected to give the best facilities for observation of fire.
 - vii. To ensure that no target is lowered without an order. In slow practices, the target will not be lowered until the officer is in front of it. In rapid practices, the target will be lowered to "half-mast" at the end of the time allowed, and the markers will be ordered to stand as far back as possible until the officer is in front of it.
 - viii. To cause all targets to be lowered during cessation of fire.
 - ix. To regulate the exposure of targets according to the instructions laid down, and to ensure that the "value of each hit" is correctly signalled. In snapshooting practices, to ensure that each target is correctly exposed in order to be clearly visible to the firer. Snap-shooting targets should be put up straight and not swung sideways.
 - x. To check the target of each firer and enter in ink the value of all hits in the register; occasional shots will be entered in the columns provided for the purpose. No erasures will be made. If alteration is necessary, a fine line will be drawn through the figure, the correct value written against it, and the amendment vouched for by the officer's initials.

- xi. If more hits, including ricochets, are found on a target than rounds fired, to deduct from the score the value of the highest scoring hits. Only those hits which are to count will be entered on the register. (In the case of the machine gun, *see* Pamphlet No. 7.)
- xii. To mark off each hit on the target with a red pencil before entering its value in the register, and to ensure that all shot holes are correctly patched.
- xiii. In rapid practices, after each check, to cause the number of hits of each value to be signalled on each target.
- xiv. On the conclusion of a practice, to rule a line diagonally across the unused spaces in the register before signing it.

4. Regulations for non-gallery ranges:—

On non-gallery ranges, the arrangements for inspection, patching, etc., of targets will be made by the officer i/c Firing Point, who will use the regulations for gallery ranges, when applicable, as a guide.

20. Signalling and Scoring

1. The standard of scoring which follows is given as a guide and will apply, unless otherwise stated in Small Arms Training, Volume I, Pamphlet No. 18. Shots cutting the edge of any ring, rectangle, or figure will be counted to the benefit of the firer.

Type of target	Points for score	Method of signalling
4 ft. and 6 ft. grouping and application (Rifle) (Fig. 3 or 5)	4	White disc placed on shot hole.
4-in. group (100 yds.)	25	
1 " " (25 ")	25	
Inner	3	Black disc waved twice across face of target, and placed with centre on shot hole.
8-in. group (100 yds.)	20	
2 " " (25 ")	20	
Magpie	2	Disc revolved in front of target and then placed with centre on shot hole; black side exposed.
12-in. group (100 yds.)	15	
3 " " (25 ")	15	
Outer	1	Black disc moved vertically up and down left of target and then placed with centre on shot hole.
12-in. group (100 yds.)	10	
1 wide	10	
3-in. group (25 yds.)	10	Red and white flag shown on same side as direction of miss. If the direction cannot be determined, the flag will be waved across the face of the target.
1 wide	10	
Ricochet, miss, or remainder of target not within outer circle	Nil	

Type of target	Points for score	Method of signalling
Grouping (L.M.G.)		
2-in. group (25 yds.)	10	
Four shots within ring		
3-in. group (25 yds.)	6	
Four shots within ring		
4-in. group (25 yds.)	2	
Four shots within ring		
Snapshooting	3*	Target twirled above gallery.
Figure targets	3*	
L.M.G. screens		
Each scoring rectangle containing:—		
1 shot	2	
2 shots	4	
3 " "	6	
4 or more shots	8	

* Variable in battle shooting.

NOTES

Rifle groups will be measured with wire rings four, eight, and 12 inches in diameter. No points will be awarded to a group unless there are five shot marks on the target. If there are more than five shot marks, there will be no score and the practice will be repeated. Where it is found impracticable for the firer to go to the target, groups will be signalled (*see* section 20, para. 1), and the position of the M.P.I. will be shown by placing the centre of the marking disc on it.

In rapid practices, bull's-eyes and inners will score three points, and will be signalled as bull's-eyes.

21. Competitions

1. The competitive element is an incentive to weapon training efficiency, provided that it is not carried to excess. Competitions at weapon training meetings should be so framed that they lead to efficiency in battle shooting, and should induce the participation of the largest number of entrants possible. Team competitions are preferable to individual events, as they make for the attainment of a good average standard.

2. Competitors should be divided into classes according to their rank, experience, and ability. A convenient division is

as follows :—

Officers and senior N.C.Os.
Serjeants and corporals.
Soldiers, including lance-corporals.

or

1st and 2nd class shots.
Recruits.

Team competitions should be based on the war organization of units and the " packing " of teams should be prevented as far as possible.

Programmes should embrace all weapons and, to prevent undue practice beforehand, they should not be published until a few days before the meeting.

Prizes should be many and small rather than few and large.

22. Returns and Records

1. The following is a list of weapon training returns, records, registers, etc. Full particulars and directions for compiling them are contained on each form.

Records of ammunition expenditure will be entered in A.B. 99 on each day that firing takes place, and A.F. B 159 and 159A will be completed.

A.F. B 159.	} Inspection of Arms and Equipment.
" B 159A.	
" B 193.	
" B 186.	
" B 189.	
" B 190.	
" B 2050.	Machine-Gun Firing Point Register.
" B 2050A.	" " Butt Register.
A.B. 99.	Record of Ammunition Expended.

Although in war time company, etc., annual returns (B 192) need not be kept officially, yet it is vitally important that a record of all men's results be kept by companies. This record may be kept in any suitable note book, and should show each man's total score and qualifications with the various weapons.

2. *Badges.*—As War Courses do not give a standard for marksmen with either the rifle or light machine gun, marksmen's badges will not be awarded. (War Clothing Regulations, 1941.)

23. Metal Fund

This fund will be held in abeyance for the duration of the war, but in the meantime headquarters of commands are responsible for the collection and the disposal, in accordance with A.C.I. 538 of 1942, of the metal from small arms ranges.

APPENDIX I

ZEROING AND TESTING

ZEROING

1. Before the rifle and L.M.G. courses are fired, and at any other time when considered necessary, weapons will be zeroed to ensure that the sighting is true for direction and elevation. A useful method of ascertaining the number of weapons that will require zeroing is to fire a *grouping* practice at 100 yards. Provided that a good group is obtained, any adjustment that may be necessary to the sighting will be indicated by the position of the *mean point of impact* in relation to the point of aim.

Vertical errors are corrected by fitting a different foresight, and lateral errors by movement of the foresight on the block. A weapon should never be left with a remaining lateral error. Any alterations will be made by the armourer-serjeant, who must be present when zeroing or testing is in progress.

Records of zeroing will be made for the rifle in the soldier's record book, and for light machine guns in the section commander's record book. Any remaining vertical error after adjustment will also be noted, so that the necessary allowance can be made by the firer at each distance.

All light machine-gun barrels should be zeroed, especially when new barrels are fitted.

2. The general conditions under which zeroing will be carried out, for all weapons, are :—

- i. *Examination before test.* Weapons must be examined by the armourer before test to ensure that all screws are tight, and that the barrel is not influenced by the fore-end, in the case of the rifle.
- ii. *Weather conditions.* Good shooting light and the calmest available weather conditions must be chosen.
- iii. *The bore must be dry and clean, and should be warmed by firing into the stop-butt before making the group.* (Rifles, 2 rounds. Light machine guns, 5 rounds.)
- iv. *Sights will be set at :—*
200 yards for the rifle. (Windgauge, if any, to be central.)
200 yards for the light machine gun.

- v. Range.
Rifle and light machine gun. 100 yards from foresight to target is the most suitable range.
25 yards may be used as an alternative.

- vi. Position.
Rifle. Lying. Forearm and wrist rested (not the rifle).
Light machine guns. Lying, bipod on firm ground.

- vii. Targets.
Rifle and light machine gun. At 25 yards a representative target (Small 200/25), which must be fixed upright, or a plain white screen with a 1-inch black aiming mark.

At 100 yards 4-foot target with a white patch on the figure.

- viii. Sighters.
Sighting shots may be fired, as required, in zeroing the .303-inch Vickers machine gun.

- ix. Stoppages.
If a stoppage occurs, the group will be repeated.

- x. Wind allowance.

Aim must be taken at the aiming mark, the necessary deflection being previously found by a known straight shooting weapon or by estimation.

3. Conditions particular to the various weapons and the standards of grouping are as follows :—

- i. No. 1 rifle.—The backsight ramps are curved to give the correct increases in elevation for longer ranges, provided that the rifle is correctly sighted at 200 yards, i.e. the shot will strike the point of aim approximately at that range.

A group of five shots will be fired by a skilled firer, taking the same point of aim for each shot. Groups will be repeated after any adjustment of the foresight in order to verify.

The permissible variation in the mean point of impact for a rifle correctly sighted is given in the table below. Alterations to the position and/or size of the foresight will be made until the weapon groups to the correct position.

There are seven sizes of foresight available for adjustment of vertical errors. The difference of one size gives the following alterations to the M.P.I.

At 100 yards, 2.77 ins. or approx. 3 ins. rise or drop on the target.

At 25 yards, 0.69-in. or approx. $\frac{3}{4}$ -in. rise or drop on the target.

Actual distance between firer and target	Sight adjustment	Correct position of M.P.I. with reference to aiming mark	Permissible variation in position of M.P.I. from correct point
100 yards	200	Approx. 3 ins. directly above centre of lowest edge.	Not exceeding 2 ins. above or below.
25 yards	200	Approx. $\frac{3}{4}$ in. directly above centre of lowest edge.	Not exceeding $\frac{1}{2}$ in. above or below.

- ii. No. 3 rifle (P. 14).—There are nine sizes of foresight available. The difference of one size gives the following alterations to the M.P.I. At 100 yards 1.7 ins. or approximately 2 ins.; and at 25 yards .425 in., or approximately $\frac{1}{2}$ -in. rise or drop on the target.

The position of the M.P.I. and the permissible variation allowed are the same approximately as for the No. 1 rifle.

A No. 2 cramp is required for adjustment.

- iii. No. 4 rifle.—This rifle must be zeroed with the bayonet fixed. There will probably be seven sizes of foresight available. The difference of one size gives the following alterations to the M.P.I. :—

At 100 yards, 1.89 ins., or approximately 2 ins. rise or fall on the target.

At 25 yards, .475 in., or approximately $\frac{1}{2}$ -in. rise or fall on the target.

Actual distance between firer and target	Sight adjustment	Correct position of M.P.I. with reference to aiming mark	Permissible variation in position of M.P.I. from correct point
100 yards	300 (bayonet fixed)	Approx. 6 ins. above centre of lowest edge.	Not exceeding 1 in. above or below.
25 yards	300 (bayonet fixed)	Approx. 1½ in. above centre of lowest edge.	Not exceeding $\frac{1}{4}$ in. above or below.

- iv. Light machine guns.—A skilled shot will fire five single rounds. The table following shows the permissible variation in the M.P.I. for a light machine gun.

There are five sizes of foresight available for adjustment of vertical errors. The difference of one size gives the following alterations to the M.P.I. :—

At 100 yards, 3.48 ins., or approximately $3\frac{1}{2}$ ins. rise or drop on the target.

At 25 yards, 0.87 in., or approximately $\frac{7}{8}$ in. rise or drop on the target.

Actual distance between firer and target	Sight adjustment	Correct position of M.P.I. with reference to aiming mark	Permissible variation in position of M.P.I. from correct point
100 yards	200	Approx. 3 ins. above centre of lowest edge.	Not exceeding 3 ins. above or below.
25 yards	200	*Approx. 1 in. to right of centre of lowest edge.	Not exceeding $\frac{3}{4}$ in. above or below.

* Lewis gun approximately centre of lowest edge.

v. .303-in. Vickers machine gun.—Lateral adjustment of foresight. Range 25 yards (*see Handbook of Vickers Machine Gun, 1930, page 130*).

vi. Any weapon that in the hands of a skilled firer fails to make a good group will be tested.

TESTING

4. The conditions for testing will, when applicable, be as for zeroing (*see para. 2*). The results of tests with all relevant details will be recorded on A.F. B 202 and forwarded to the Chief Inspector of Small Arms, Enfield Lock, if the standards given hereinafter are not reached.

5. A group of single shots will be fired in rifle tests, but, in order to distinguish between inaccuracy due to the barrel and inaccuracy due to some defect in the gun, Vickers guns and light machine guns will be subjected first to a barrel test and then to a complete gun test.

6. *Vickers .303-in. M.G. and light machine guns, barrel test.*—A skilled shot will fire 10 single shots, carefully relaying the gun and taking the same aim for each shot. In bringing the sights of the Vickers gun on to the mark, the gun will be elevated on each occasion so that any play in the elevating gear will always be taken up in the same direction.

At 400 yards range all shots must fall within a square of 24-in. sides.

Barrels will be exchanged if they fail to reach this standard, provided that a satisfactory group is obtained with a known good barrel with the same gun and tripod.

7. *General instructions.*—i. The exact position of the shot holes will be measured to one place of decimals horizontally and vertically from the left and bottom edges of the target respectively, except for tests of the .22-in. rifle, when the targets used will be forwarded with A.F. B 202.

ii. Shots will be recorded in the order in which they are fired in the test of rifles.

iii. If any shots are not on the target, groups will be repeated once, any suitable alteration of aim being made for direction and elevation. If the alteration fails to bring all the shots on to the target, the fact will be recorded on A.F. B 202.

iv. A check group will be fired, by the same firer and with ammunition from the same batch, with a weapon known to be reliable. The results will be recorded on A.F. B 202.

v. Tests of complete .303-in. Vickers machine guns will be carried out with a known good barrel.

8. *Details and individual weapons.*—The details for the various weapons and the standard of grouping are given in the table below :—

Weapon	Number of rounds and method of firing	Range	Size of rectangle containing the group measured horizontally and vertically		Permissible distance of M.P.I. from point of aim
			inches	inches	
Rifle	10	yards 200	8	8	4
Light machine gun	3 groups, each of 10 rounds, fired in service bursts	$\left. \begin{matrix} 200 \\ 25 \end{matrix} \right\}$	$\begin{matrix} 24 \\ 3 \end{matrix}$	$\begin{matrix} 24 \\ 3 \end{matrix}$	$\begin{matrix} 8 \\ — \end{matrix}$
.303-in. Vickers machine gun	3 groups, each of 10 rounds, fired in one burst	$\left. \begin{matrix} 400* \\ 25 \end{matrix} \right\}$	$\begin{matrix} 36 \\ 2\frac{1}{2} \end{matrix}$	$\begin{matrix} 36 \\ 2\frac{1}{2} \end{matrix}$	$\begin{matrix} 8 \\ — \end{matrix}$
Rifle No. 2. .22-in.	2 groups, each of 5 rounds	25	$1\frac{1}{2}$	$1\frac{1}{2}$	—

* For convenience, the test and barrel test may be fired at 200 yards, the passing limits being reduced proportionately.

APPENDIX II

COACHING

PART I

1. *Object of range practices.*

- i. Range practices are the advanced stage of elementary training which precede service shooting.
- ii. Their object is to give a firer confidence in his rifle and his ability to become a practical service shot.

2. *Need for efficient firing point instructors.*

- i. To gain the necessary confidence the young soldier must shoot well on the range.
- ii. Therefore, to help the firer to obtain good results, he is provided with a *coach*.

3. *Knowledge essential to efficient coaching.*

- i. Powers and limitations of rifle and ammunition combined.
- ii. Powers and limitations of rifle, ammunition, and firer combined.
- iii. Study of firer's temperament and harmony with firer.
- iv. Encouragement.
- v. *Some of the causes of inaccurate shooting.*

Causes within the firer's control

(a) Faults in aiming, such as inclined sights, dwelling too long in the aim, failing to maintain elevation when aiming off for wind.

(b) Faults in trigger pressing, for example, not taking the first pressure correctly, or snatching the trigger instead of squeezing.

(c) Faults in position, body and elbows incorrect, eye too close to the cocking piece, left wrist and forearm (or rifle) incorrectly rested.

(d) Faults in the rifle, wrong bolt or bayonet, cord wear, loose butt or screws due to carelessness.

(e) Faults in the firer, incorrect breathing, gun shyness, overkeenness, untruthful declarations, lack of determination, and preventable physical unfitness.

Causes outside the firer's control

(a) Difficult atmospheric conditions such as bad light, mirage, strong or variable winds.

(b) Faults in the rifle—sights in need of browning, either incorrectly zeroed or not zeroed, butt not fitting the firer, worn chamber or barrel, nickelling in bore, loose screws due to vibrations of firing.

(c) Faults in firer, defective eyesight, unavoidable illness, inadequate preliminary instruction.

(d) Faults in coaching—inexperienced coach, impatience on the part of the coach, too much "hustle."

vi. Coaching is an art. There are no fixed rules, only guiding principles. Steady perseverance, great patience, and a great deal of practice are required to master the art.

vii. A coach must understand that *grouping is the foundation of all shooting*. It is on a man's capacity to group his shots round a mark that his ability to apply his fire to any given target will depend.

4. *Powers and limitations of rifle and ammunition alone.*

- i. All rifles are tested at the factory under conditions which ensure the greatest accuracy.
- ii. Rifles before issue must group to $1\frac{1}{2}$ ins. by 1 in. at 100 feet, i.e. $4\frac{1}{2}$ by 3 ins. at 100 yards.
- iii. Ten per cent. of rifles before issue must group to 2 feet at 600 yards.
- iv. *Show the above-mentioned dimensions by diagram.*

5. *Demonstrate and explain.*

- i. What is meant by a "group."
- ii. That this group is the measure of the capacity of the rifle and ammunition combined.

6. *Powers and limitations of rifle ammunition and firer combined.*

- i. When the rifle is fired by a man alone it will be appreciated that the resulting group is unlikely to be smaller, if as small, as that obtained at the factory.
- ii. Therefore, with the S.M.L.E. rifle and Mark VII ammunition and fired by the man alone, the smallest area which will contain all his shots is taken to be a 4-inch circle at 100 yards, provided that all shots are fired accurately.
- iii. It follows that the worse the firer the larger the area that will contain his shots.
- iv. In this case the group is the measure of capacity of the rifle, ammunition, and firer combined.
- v. *Show the three sizes of group measuring rings (4-in., 8-in. and 12-in.) which are used for measuring the grouping capacity of firers at 100 yards.*

7. *Demonstrate, with group measuring rings :—*

- i. The grouping capacities of the 4-in., 8-in. and 12-in. groupers at 100 yards when firing at 200, 300, 400 and 500 yards.
- ii. *Explain* that the main object of preliminary instruction before firing the annual course is to improve a man's grouping capacity.
- iii. That the average size of a man's group obtained in preliminary instruction provides his coach with valuable information when coaching him in application practices.
- iv. Therefore, all such groups must be carefully recorded in the firer's record book (A.B. 142).
- v. Men who fail to reach a 12-in. grouping standard at 100 yards are not fit to fire application practices on the open range.
- vi. Once the size of a man's average group is known, the area at any range which should contain all his shots is also known.

For example :

- A 4-in. grouper at 100 yards firing at 200 yards, shots will be contained in 8-inch circle.
 A 4-in. grouper at 100 yards firing at 300 yards, shots will be contained in 12-inch circle.
 A 4-in. grouper at 100 yards firing at 500 yards, shots will be contained in 20-inch circle.

The same applies proportionately to the 8-in. and 12-in. groupers at these ranges.

- vii. The above principles are equally true for the firers who can group their shots into areas lying between the three standard sizes of groups.

For example. A man who normally groups to 6 ins. at 100 yards will know that at 300 yards he can expect an 18-in. group.

- viii. In addition to knowing a man's *normal* group, the coach must know the position of the centre or M.P.I. of the group. This position he can obtain from the soldier's record book and from the man himself.
- ix. If correctly sighted and the rifle is fired accurately with the sights set exactly at 200 yards the correct position of the M.P.I. of the group will be :—

At 200 yards ...	...	...	Central to point of aim.
At 100 yards ...	...	...	3 ins. high to point of aim.
At 25 yards ...	...	...	$\frac{3}{4}$ in. " " "

Show, using 4-foot and representative target (200/25).

- x. If it is known where the M.P.I. of a group, fired from an accurately sighted rifle, should be, it is an easy matter to alter the sighting of any rifle which is found to be shooting inaccurately. This process is zeroing.
8. *Demonstration of coaching when firing a grouping practice on the open range.*
- i. Object. To show how to coach a grouping practice on the open range.
 - ii. Imagine that firing is on the 100 yards firing point.
 - iii. Show the position of each shot, using spotting discs, as it arrives on a 4-foot target. (Diagram No. 1.)

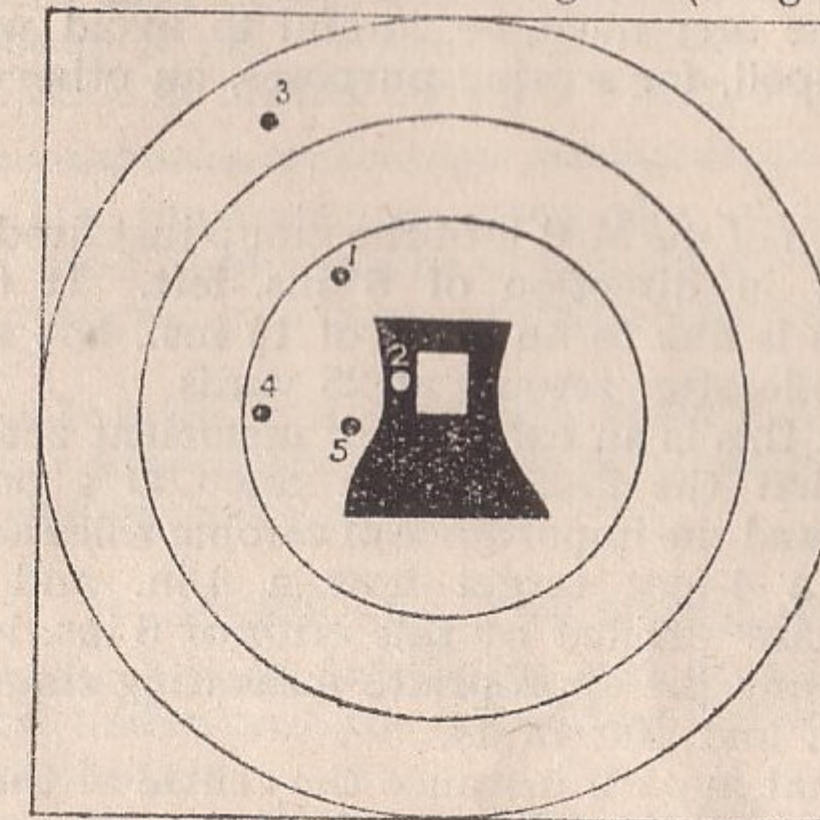


DIAGRAM NO. 1

- iv. *Point out* actions of coach before the practice begins.
 (Inspection of rifle. Examination of record book to find out firer's grouping capacity and position of M.P.I. of previous groups. Allot target and explain practice to firer.)
- v. *Stress* the following actions of the coach during the practice.
 Same position as firer but does not touch firer.
 Watches firer carefully for holding, breathing, trigger pressing, flinching, and lack of determination.
 Checks faults while firer rests.
 Notes firer's declaration in record book or on representative target.
- vi. *Demonstrate* coach's examination of group after the practice.
 (a) Comparison of order of arrival of shots with firer's declaration.

- (b) Size of group for scoring purposes and entry of the necessary details in the firer's record book.
 - (c) Size of group for coaching purposes.
 - (d) Discuss position of M.P.I. of group as regards direction and elevation.
 - (e) Point out how pattern of group is regular and discloses no error.
- vii. Stress encouragement given by the coach, the fact that, owing to truthful declarations by the firer, he can be credited with an 8-in. group for coaching purposes, and the necessity for efficient marking in the butts. How the firer must be careful to avoid wide shots which spoil, for scoring purposes, an otherwise good group.
9. Zeroing.
- i. The position of the M.P.I. of the group just fired discloses an error in direction of 6 ins. left. It transpires that this is due to an error of $1\frac{1}{2}$ ins., left remaining on the rifle after zeroing at 25 yards.
 - ii. Stress that this is an example of inefficient zeroing.
 - iii. Explain that the first call on the C.O.'s pool is for zeroing, and the importance of zeroing rifles accurately.
 - iv. Show on a 4-foot target how a 4-in. and a 12-in. grouper are affected by this error of 6 ins. left at 100 yards, using the appropriate measuring rings for 200, 300, 400, and 500 yards.
 - v. Explain that in each instance the centre of the measuring ring represents the M.P.I. of the group.
 - vi. Emphasize how the good shot is more handicapped by this inaccurately zeroed rifle than the poor shot and how, when engaging a small target in battle shooting or an unsignalled practice such as rapid, the good shot may get no fire effect, whereas the poor shot may obtain some.

PART II

10. Application.

- i. The term denoting the soldier firing each shot up to his best capacity and trying to keep the M.P.I. of his group or cone of fire on the centre of the target.
- ii. With each shot, if it is well fired, the firer engages the target with his cone of fire, which is the same size as his normal group for that particular range.
- iii. Demonstrate with measuring rings on a 4-foot and 6-foot target the area on the target which will contain the cone of fire of an 8-in. grouper at 100 yards firing at

300 yards, and a 4-in. grouper at 100 yards firing at 500 yards, provided that each man is firing up to his normal grouping standard.

- iv. It is only reasonable to assume that a rifleman firing single shots will obtain a better group than the light machine gunner, who obtains a burst of penetrations almost simultaneously by one pressure of the trigger, both weapons being shoulder controlled.

A light machine gunner, firing with the same accuracy, and who can group to 4 ins. at 100 yards with the rifle would find, when firing service bursts with the L.M.G., that his group at 100 yards would be about 8 ins. When firing single rounds from the L.M.G. he should obtain a 4-in. group at 100 yards.

11. Demonstration to show how intelligent coaching helps a firer.

Object. To illustrate the principles of coaching and to show that good results can be obtained only when information given by grouping practices is intelligently used in application practices.

(NOTE.—It will be appreciated more easily if the harm that can be done by bad coaches is compared with the good done by well-trained coaches.)

1. PART I. The wrong way

- i. The coach is an intelligent and keen N.C.O., but does not understand the connection between grouping and application.
- ii. The firer is a 12-in. grouper at 100 yards and is firing an application practice at 300 yards. (Diagram No. 2.)

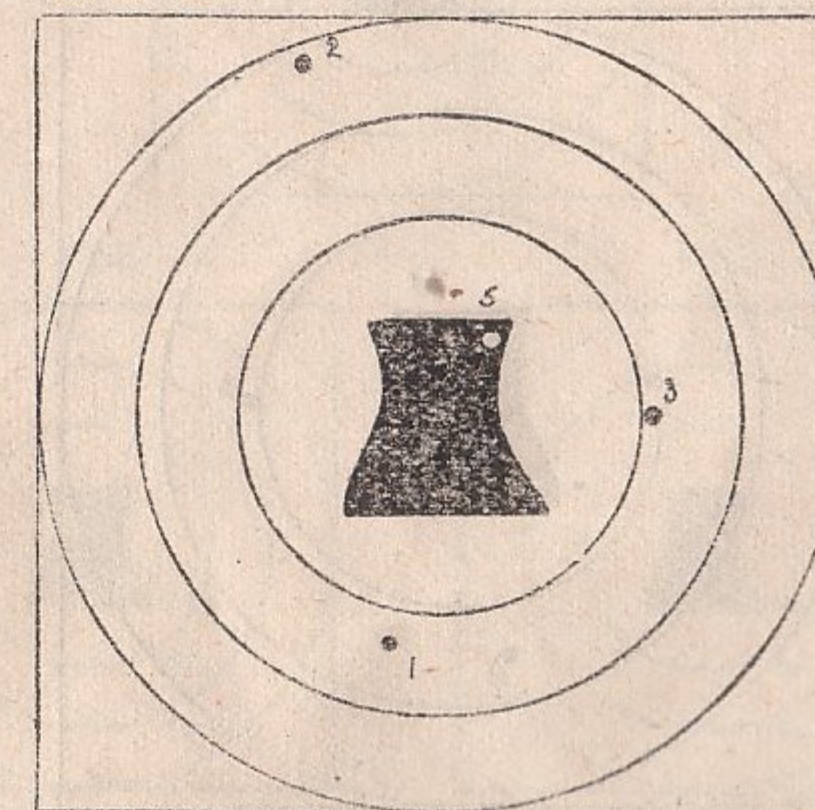


DIAGRAM NO. 2

- iii. The following was the coach's advice :—
- | | | |
|--------------|-----|---|
| 1st shot ... | ... | Sights at 300 yards. |
| 2nd shot ... | ... | Sights up to 400 yards, thus raising the M.P.I. 1 foot. |
| 3rd shot ... | ... | Sights down to 300 yards. |
| 4th shot ... | ... | Aimed off one width to the left, thus moving the M.P.I. about 12 ins. left. |
| 5th shot ... | ... | Aims central. |
- iv. Discuss each shot in turn, and with aid of measuring rings show how the centre of the firer's group was moved and the effect on the position of each shot as a result of the advice given by the coach.
- v. Comment on :—
- Score obtained.
 - Who claimed credit for the last shot.
 - Encouragement given the firer.
 - Confidence of firer in his coach.
 - Confidence of firer in himself and his rifle.
- vi. The whole trouble was that the coach did not realize from his study of the firer's A.B. 142 that the man is a 12-in. grouper at 100 yards and was shooting up to his best capacity and applying the centre of his group to the centre of the target. No alteration in elevation should therefore have been advised.

2. PART II. The right way

- i. Explain that the same practice is going to be repeated by the same firer, but that this time the coach is well trained and understands the principles involved.

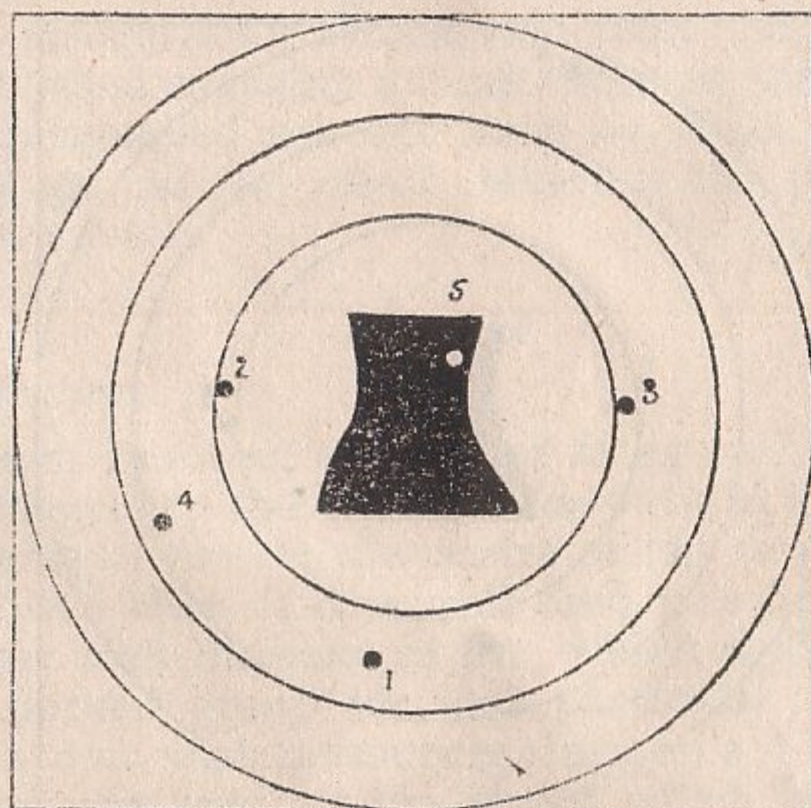


DIAGRAM No. 3

- ii. Compare the result of the two shoots shot by shot, bringing out how the coach did not allow the sight's to be altered so long as the shots were inside the firer's normal grouping capacity, and the M.P.I. of the group was falling on the centre of the target. (Diagram No. 3.)
- iii. Discuss the points brought out in para. 1, v, above, and emphasize in addition the realization by the coach of marked signs of improvement in grouping capacity on the part of the firer, and how the coach explained to the man the principles in connection between grouping and application at the end of the practice.
- v. Stress how this system of coaching becomes useless unless the firer truthfully declares each shot.
12. Alteration of sights.
- i. Discuss and show by demonstration when alteration in sighting elevation should or should not be made during application practices.
- ii. Using three 4-foot targets, explain that a 4-in. grouper at 100 yards is firing on No. 1 Target, an 8-in. grouper on No. 2 and 12-in. grouper on No. 3, and that spotting discs represent the first and subsequent shots fired by each man. Each firer is firing at 300 yards. (Diagram No. 4.)

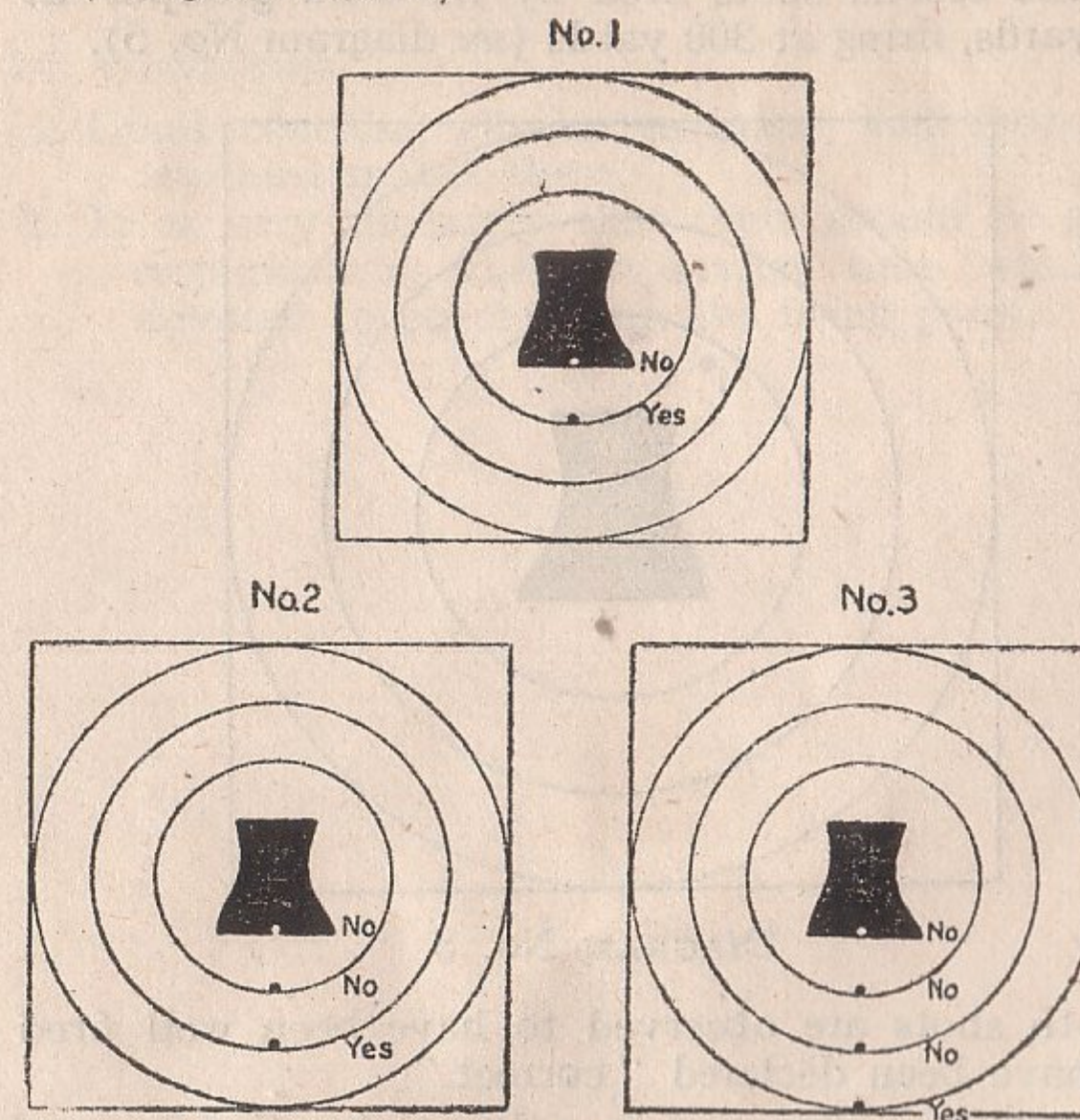


DIAGRAM No. 4

iii. Take as an example No. 1 Target.

(a) First shot. Any alteration? No, because the shot lies within the minimum area expected from this firer at this range. The position of the firer's group is where it should be, i.e. central.

(b) Second shot. Any alteration? Yes, because the shot was observed to have been correctly fired and the shot was declared "correct."

Therefore, it is probable that this shot was up to the firer's normal grouping standard. Thus, if it is inside the area to be expected at 300 yards from a 4-in. grouper at 100 yards, the "area" itself must be low. Therefore, more elevation is necessary.

(c) Mention how shots which are declared incorrect or to have been fired in a doubtful manner must be ignored, and again stress the need for truthful declarations.

iv. Deal with first and subsequent shots on Nos. 2 and 3 targets similarly.

13. Problem.

- i. Using a 4-foot target and spotting discs, show the first and second shots fired by an 8-in. grouper at 100 yards, firing at 300 yards (see diagram No. 5).

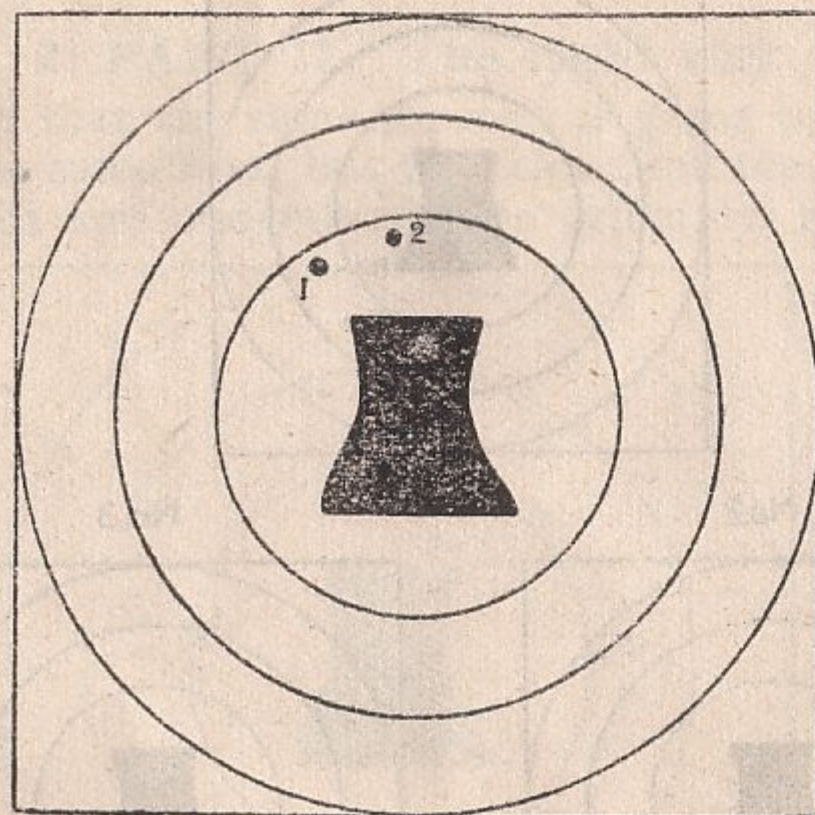


DIAGRAM No. 5

- ii. Both shots are observed to have been well fired and have been declared "correct."
 iii. Should any alteration in sighting elevation be made?

- iv. In order to apply the principles already demonstrated *no alteration should be made.*

v. It must be remembered, however, that there are no rules in coaching, only guiding principles.

vi. In this instance, the coach's knowledge of the firer and his own experience may influence him in suggesting an alteration in sighting elevation to lower this firer's group on the target.

vii. The coach might be right in altering, or better results might be obtained by adhering to the principles of coaching.

viii. The coach must decide:—

(a) Are they central shots of a group forming high, or are they high shots of a group forming in the correct place?

(b) Remembering that it is impossible to predict the spot within the 24-in. circle which each bullet will strike, it might be a coincidence that these two shots are together, and therefore they may be high shots of a group forming centrally.

(c) If this is what is happening in the case of these two shots, then any alteration in sighting elevation would be risky.

14. Conclusion.

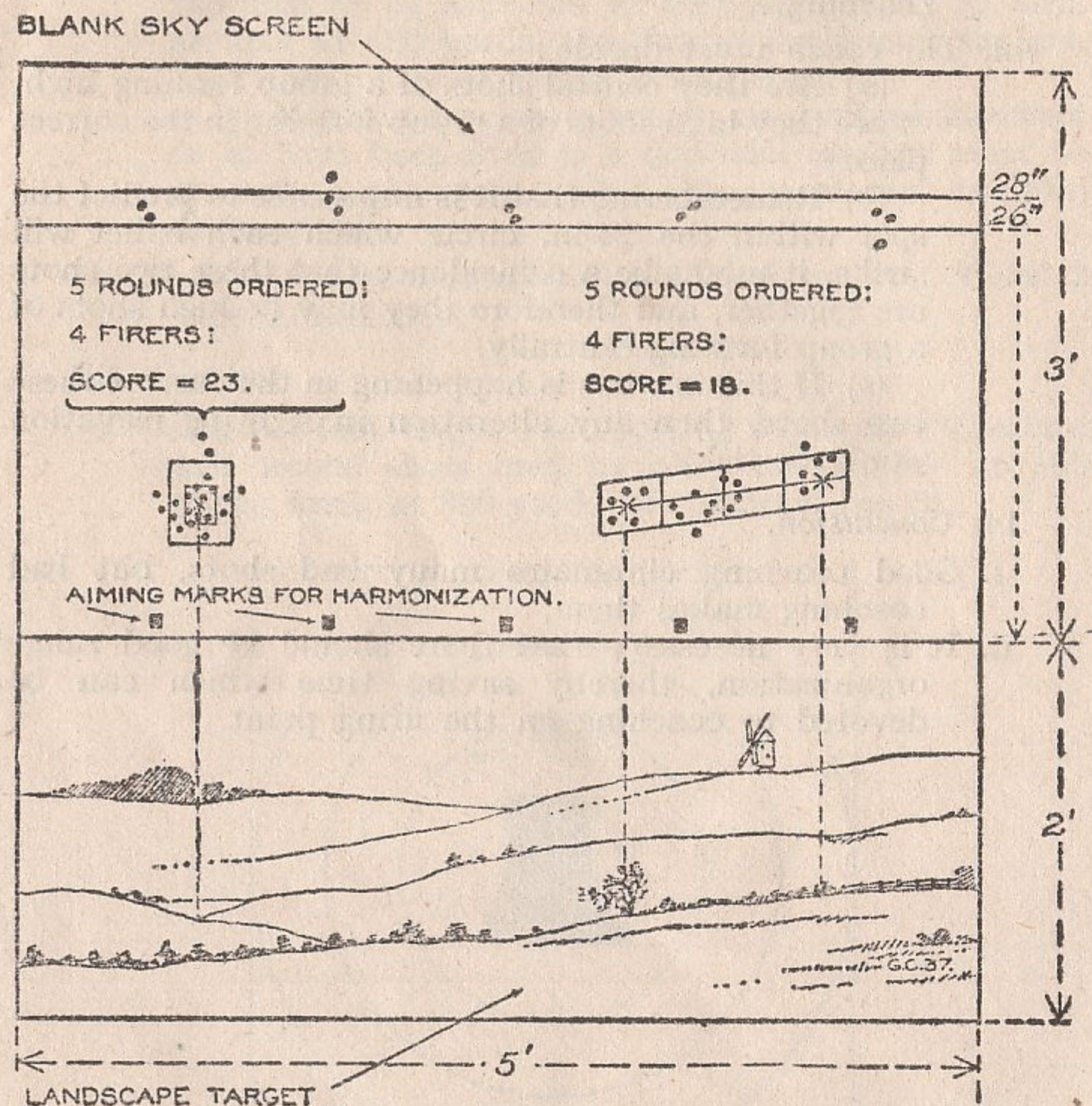
- i. Good coaching eliminates many bad shots, but bad coaching makes them.
 ii. It is very necessary that there should be good range organization, thereby saving time which can be devoted to coaching on the firing point.

APPENDIX III

USE OF LANDSCAPE TARGETS AND HARMONIZED SIGHTS

(Miniature and 30-yard ranges)

1. *Landscape targets.*—The frame for these is 10 feet long and 5 feet high. Landscapes in sheets, 5 feet by 2 feet, are



pasted on to the lower portion, leaving 3 feet of blank sky-screen above to receive the shots.

The sky-screen should be of brown paper, in order to render the bullet holes invisible to the firers. (See also S.A.T., Vol. V.)

2. *Harmonization of sights.*—In firing at landscape targets, weapons should be given extra elevation, to ensure that the bullets will strike the blank sky-screen, even if the aim is taken at an object at the bottom of the landscape; this extra elevation necessitates the weapons being harmonized in order that they all shoot to the same height above the point aimed at. Harmonization is carried out as follows:—

Put aiming marks at intervals of about 12 ins. on a horizontal line at the bottom of the blank sky-screen. (See Fig. 19.)

Draw two horizontal lines 26 ins. and 28 ins. above the aiming marks. These lines must be visible from the firing point. Set the sights to 1,400 yards. The weapons should then be fired, aim being taken at the aiming marks, and the sights adjusted until every rifle places the shots between the two lines.

The elevation for every weapon harmonized should be entered on the elevation board in each miniature range.

The above method of harmonization can equally well be carried out on the 30-yard range, the men using their own rifles and .303-in. ammunition.

3. Apparatus and method of scoring:—

i. *Concentrated target.*—A measuring rod 27 ins. long is required. When fire has been concentrated on any point on the landscape target, the rod is held vertically, the bottom of it on the point of aim. A mark is then made on the blank sky-screen at the top of the rod; this mark shows where the centre of the group should be.

For competitions, two concentric wire rectangles, 5 ins. by 4 ins. and $2\frac{1}{2}$ ins. by 2 ins., will be used to determine the score. The centre of the rectangle is placed on the mark with the longest sides of the rectangle vertical; every shot in the inner rectangle counts two points; every shot in the remainder of the larger rectangle counts one point.

ii. *Distributed target.*—When fire has been distributed between two points on the landscape, a mark is made 27 ins. vertically above each, as already described; these two marks are joined by a line parallel to that along which fire has been distributed.

This line is then produced $1\frac{1}{2}$ ins. beyond the marks at either end. A line $1\frac{1}{2}$ ins. above and another $1\frac{1}{2}$ ins. below are drawn parallel to the first line. The ends of these are joined by vertical lines passing $1\frac{1}{2}$ ins. outside the two marks and the

parallelogram thus made is again sub-divided into equal spaces, one for each firer (*see* Fig. 19). The extra $1\frac{1}{2}$ ins. at each end is to allow for the width of the cone of fire of the two flank men of the section.

All shots in the rectangle opposite the particular firer (up to the number of rounds given in the fire control order) count one point each to the total score of the section; any shot in a rectangle over and above the number ordered will not count. Shots on the dividing lines count in one rectangle only.

- iii. A miniature replica of the landscape target in use should be available on the firing point. The instructor will mark by means of pins the position or the extent of the target on the replica. The section leader, having identified the target on the landscape, will give the section a fire control order.

The section leader should give his indication from a firing position in the section, without further reference to the replica.

APPENDIX IV

TRAJECTORY TABLE

Height of trajectory (in feet) above the line of sight of the Rifle No. 1, Mark III, S.M.L.E. .303-in., firing S.A.A., .303-in., Mark VII, M.V. 2440 F.S.

Range in yards	200	300	400	500	600	700	800	900	1000	1100	1200
300	0.7										
400	1.6	1.4									
500	2.6	2.9	2.0								
600	3.7	4.4	4.1	2.6							
700	4.9	6.2	6.6	5.8	3.6						
800	6.3	8.3	9.4	9.4	7.9	4.8					
900	7.9	10.7	12.6	13.3	12.6	10.3	6.2				
1000	9.7	13.4	16.2	17.8	18.0	16.5	13.2	7.8			
1100	11.7	16.5	20.3	22.9	24.1	23.7	21.3	17.3	10.5		
1200	14.0	19.9	24.8	28.5	30.9	31.7	30.7	27.5	21.9	12.5	

RANGE TABLE

FOR RIFLES FIRING S.A.A., .303-IN., MARK VII, WITH A MUZZLE VELOCITY OF 2440 F.S.

Range	Angle of tangent elevation	Angle of descent
yards	deg. min.	deg. min.
200	0 7	0 9
300	0 11	0 15
400	0 16	0 22
500	0 22	0 30
600	0 28	0 40
700	0 35	0 52
800	0 43	1 7
900	0 52	1 25
1000	1 2	1 46

For data beyond these distances, *see* .303-in. Vickers machine gun tables.



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